The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XXVII. October 8th, 1932 No. 693

Notes and Comments

British Chemical Manufacturers

THE report presented on the occasion of the annual meeting of the Association of British Chemical Manufacturers on Thursday was a splendid record of valuable work carried out in the interests of the chemical industry during one of the most critical periods in the history of this country. It afforded evidence, if any evidence were needed, of the wisdom of those manufacturers who met together in 1916 and set up an organisation which now numbers 109 undertakings on its membership roll. The economic crisis of last year, the changes in the nation's fiscal policy, the Imperial Conference at Ottawa and the amendments in legislation governing patents and designs, apart from the innumerable problems that arise in connection with the normal development of an industry so far reaching as the manufacture and supply of chemical products, combined to make the year under review a severe testing time for the Association, and the vigour with which it handled each succeeding problem as it arose was a testimony to the soundness of the foundation on which it was built.

While the Association has been excellently served by its officers, it has never succumbed to the tendency towards bureaucracy which afflicts some such organisations. The system by which its various operations are conducted by specially constituted committees of men best qualified to deal with them has provided many members with opportunities for voicing their opinions and taking their share in influencing the destiny of the industry. The safety activities of the Association are an example. Safety problems are dealt with by the Works Technical Committee, which issued eleven new safety circulars during the year, in addition to the quarterly safety summary, which was continued as a regular feature. Co-operation was established with the Chemical and Allied Employers' Federation, and with other organisations likely to be interested in safety problems, through the National Confederation of Employers' Organisations, and the Home Office was relieved to a large extent of the task of drawing up safety regulations.

Finding Work for 25,000 Men

WHEN, last autumn, the Association explored the question of a change in the fiscal policy to allow of the imposition of duties on goods which could be made in this country, it prepared a statistical analysis of the position with regard to the chemical industry which showed that the imposition of a system of tariffs on chemicals might quite well result in the direct additional employment of 20,000 to 25,000 men, apart from accruing advantages in regard to reduction of costs, increase export trade, etc. Assurances were given by the makers of various products that they would not take advantage of any duties to exploit their consumer colleagues, and detailed recommendations were adopted for transmission to the President of the Board of Trade. Though the tariff policy in the Import Duties Bill which was introduced into Parliament a few weeks later did not follow the system of emergency tariffs which the Association and the Federation of British Industries had in mind, the agreed recommendations of the Association were largely responsible for securing the additional duties which were imposed on chemical products by the Import Duties Advisory Committee in April, and were specially effective in that they represented in many cases the agreed views of both makers and users.

The Import Duties Act has now been in operation over seven months, but there is, unfortunately, no evidence of the absorption of anything like 25,000 additional men into the employment of the chemical industry. Although the industry has fallen short of that achievement, however, it has at least the satisfaction of knowing that the disparity between exports and imports has to a great extent been remedied, and when more settled international conditions have been established there is every reason to hope for increased benefits from the operation of the new fiscal system. The industry as a whole is also looking forward to beneficial results from the deliberations at Ottawa. According to the report of the Association, the council's action in sending Dr. E. F. Armstrong and Mr. J. Davidson Pratt to the conference has been more than justified. Apart from the benefits in the way of increased preferences which will accrue to the industry, and towards which the Association's representatives were able to make a valuable contribution, the friendly contacts which they were able to establish with the chemical manufacturers of Canada and the United States and the promises of co-operation for the future would, by themselves, have been sufficient justification for their visit.

Co-ordinating Industrial Research

THROUGH the medium of a letter to the "Manchester Guardian," Mr. Alan Chorlton, M.P., has submitted for the sympathetic consideration of all those concerned in the industries of Lancashire and their future, the suggestion that a research council should be set up in Manchester. Mr. Chorlton pays a tribute to the Shirley Institute, which, under the able guidance of Dr. R. H. Pickard, the President of the Society of Chemical Industry, has done so much for the cotton industry, and to the many other undertakings which have caused

Manchester to be regarded as a research centre from the early days. He stresses, however, the need for the continuation and extension of the work in a more co-ordinated form. In describing more precisely the objects of the Lancashire Research Council, which he suggests should be set up, he paraphrases Sir David Brewster's description of the purposes of the British Association at its inception.

The principal objects would be to make "research workers in each industry acquainted with each other, to stimulate one another to new exertions, to bring the objects of research more before the public eye, to take measures for advancing its interests and accelerating its progress generally, to gain all the advantages of mutual counsel and support, locally and nationally."

Mr. Chorlton adds: "There may be much to be said against the formation of any more committees or councils, for they so often drift into being just bureaucratic, run by officials, and the urge of deep personal interest is lost. This is a mutual aid project in which the younger spirits must also be actively concerned. It is not sufficient for us just to sit and hope that Lancashire trade will return with the efflux of time. Anyone who has studied the Report on an Industrial Survey of Lancashire by the University of Manchester will only too fully, and maybe sadly, recognise this. We must by every possible means, of which research is an essential one, strive, yea fight, not each other, but together to recover our position."

Mr. Chorlton's suggestion has been cordially endorsed by Mr. A. P. M. Fleming, director of the Metropolitan-Vickers Electrical Co., Ltd., who points out that at the present time the major need is for co-ordinated and well-directed research carried on, if possible, by workers closely in touch with industrial needs and problems. The facilities for industrial research already in existence in the county must be considerable. If these can be ascertained and their availability for research outside their present boundaries determined, something may be done quickly in extending their application and utility. Mr. Fleming says one of the first activities of the body proposed by Mr. Chorlton should be, therefore, to extend, if it is practicable, the availability of existing research facilities, and for this object alone his proposal of a special body merits the sympathetic consideration of all interested and in touch with research.

The New British Pharmacopoeia

THE new British Pharmacopoeia, the sixth of its kind to be published by the General Medical Council was issued on October 1. As was to be expected, a number of preparations which were included in the Pharmacopoeia of 1914 have disappeared and a number of new preparations have been included. Among the latter are diphtheria and tetanus antitoxin, insulin, liver extract, and typhoid-paratyphoid vaccine. These subsances represent some of the most important conquests of disease which have been achieved during the last half-century. They represent also the gradual change which is taking place from a crude and almost casual use of drugs to a therapy based on the principles of exact science. The new Pharmacopoeia possesses the merit of recognising the difference between the science of pharmacology and the art of treatment. The General Medical Council is to be congratulated on the work of its Pharmacopoeia Commission, but congratulation is due also to the Medical Research Council for the influence which it has evidently exerted.

The Pharmacopoeia is designed to serve the uses of the whole British Commonwealth of Nations. For this reason preparations having a local rather than a general use have been omitted and the duty of producing supplementary lists left to those authorities who may consider them to be necessary. The advantage of this change in the character of the Pharmacopoeia is obvious; it is likely to be enhanced by the efforts which have been made to conform, so far as has been deemed advisable, with the international agreement for the unification of pharmacopoeial formulas for potent drugs. The British Government assented to this agreement with a reservation, and the differences between the provisions of the agreement and those of the Pharmacopoeia are set out fully. In other directions efforts have been made to keep British practice in line with that of some foreign countries. Thus the standards—or their equivalents—proposed by the Permanent Commission on Biological Standardisation, appointed by the Health Committee of the League of Nations, have been accepted and the use of these standards is obligatory. The botanical nomenclature has been revised and is in accordance with the international rules of botanical nomenclature.

Royalty and the Gas Industry

THE keen interest which the members of the Royal Family take in industrial affairs was exemplified last week, when Prince George attended the dinner at Leeds Town Hall in connection with the coming-of-age conference of the British Commercial Gas Association. Three years ago the Duke and Duchess of York attended the annual conference of the Association at Eastbourne, and this year the Prince of Wales opened a £1,000,000 coke oven plant at the Beckton works of The Gas Light and Coke Company—works which were honoured by a visit from the King and Queen in 1926 on the occasion of the opening of new coal conveying plant. At last week's dinner, Prince George expressed his interest in the way in which gas and electricity were complementary and essential to each other in the services they rendered to the country. The two industries were, indeed, sister servants of humanity, and one might almost say twin sisters, but for the disparity in their age. Throughout his visits to a large number of factories at Leeds, His Royal Highness was struck by the variety of ways in which gas was utilised in industry. He saw gas being used most successfully in various processes in laundries, printing houses, chemical works, general engineering works, jam and confectionery factories and in the textile, tailoring, wireless, glass and pottery industries.

Special attention was devoted at the conference to the industrial uses of gas, papers on this subject being presented by Mr. A. W. Smith, general manager and secretary of the Birmingham Gas Dpeartment, and Colonel W. M. Carr, engineer, general manager and clerk of the Stretford Gas Board. Major G. H. Kitson, chairman of the Leeds Gas Committee, was succeeded in the presidential chair by Mr. William Cash, chairman of the Bournemouth Gas and Water Company, who invited the Association to hold its conference at Bournemouth next year.

Hydrogen Ion Concentration

Its Determination by Indicator Methods

This article is based on a communication from the Analytical Laboratories of The British Drug Houses, Ltd. It defines "*pH* value" in a manner which is easily understood, and deals with the use of indicators, buffer solutions, comparator and capillator, in the determination of *pH* values.

THE *pH* value of a fluid is a number used to express its active acidity or alkalinity. According to the theory of electrolytic dissociation all liquids of which water is a constituent contain free positively charged hydrogen (H+) ions and negatively charged hydroxyl (OH−) ions. When the numbers of these two ions present in a liquid are exactly balanced the liquid is said to be neutral. If there be an excess of hydrogen (H+) ions the liquid is acid, and conversely if the hydroxyl (OH−) ions be in excess, it is alkaline. The actual concentration of these ions is in any case very small, and as the product of their concentrations known as the constant of water (K_W) for the same temperature is always the same ($C_H \times C_{OH} = 10^{-14}$ at 18° C.), it follows that if one of these be known the other may be readily ascertained. In practice, therefore, it is usual to speak only of the H ion concentration. This concentration, expressed as the number of grams of active or ionised hydrogen in 1 litre of the liquid is represented by the symbol [H+].

Decinormal (0.1N) hydrochloric acid has a H ion concentration of 10^{-1} (more exactly $10^{-1.04}$),that is, 1 litre of 0.1 N HCl contains 10^{-1}, or 0.1 gram of ionised hydrogen. On the other hand, decirnormal (0.1N) solution of sodium hydroxide has a H ion concentration of $10^{-13.07}$ (8.6×10^{-14}). One litre therefore contains only 0.000,000,000,000,086 gram of ionised hydrogen. Figures such as these are inconvenient for practical purposes, and the basis which has been universally adopted is the index of the H ion concentration with the negative sign changed to positive. This quantity is known as the *pH*. In the foregoing examples the H ion concentrations of 0.1N H.Cl and 0.1N NaOH are respectively $10^{-1.04}$ and $10^{-13.07}$. The *pH* values are therefore 1.04 and 13.07.

Absolute Neutrality

The *pH* of pure water at 18° C. is 7.07 (usually given as 7.0). It is taken as the standard of absolute neutrality as the concentrations of the H and OH ions are exactly balanced. The addition of any acid or alkali immediately upsets this balance, acid causing an increase in the H ions and a corresponding decrease in the OH ions, in consequence of which the *pH* will become less than 7.07. Alkali, on the other hand, decreases the H ions and increases the OH ions; the *pH* of all alkaline solutions is therefore greater than 7.07.

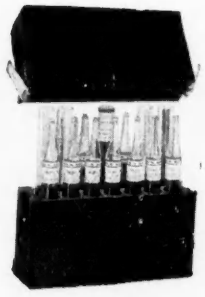
The range of *pH* values extends about equidistant on each side of absolute neutrality (*pH* 7.07). The highest concentration of H ions possible at normal temperature is about 2, *i.e.*, 2 grams of ionised hydrogen per litre = *pH* −0.3. This occurs in hydrochloric acid of a strength about six times normal. The lowest possible H ion concentration is in a strong alkaline solution—about seven times normal potassium hydroxide; the actual concentration being 3.3×10^{-15} gram per litre = *pH* 14.5. The complete range of *pH* values thus extends from about −0.3 to 14.5 and forms a graduated scale in which the concentrations represented by the numbers decrease in logarithmic order; in other words, each whole number indicates one-tenth of the concentration of the preceding whole number. For example:—

pH 0 = 1 gram ionised hydrogen per litre.
,, 1 = 0.1 gram ionised hydrogen per litre.
,, 2 = 0.01 gram ionised hydrogen per litre.
,, 3 = 0.001 gram ionised hydrogen per litre.
,, 14 = 0.00000000000001 gram ionised hydrogen per litre (14 decimal places).

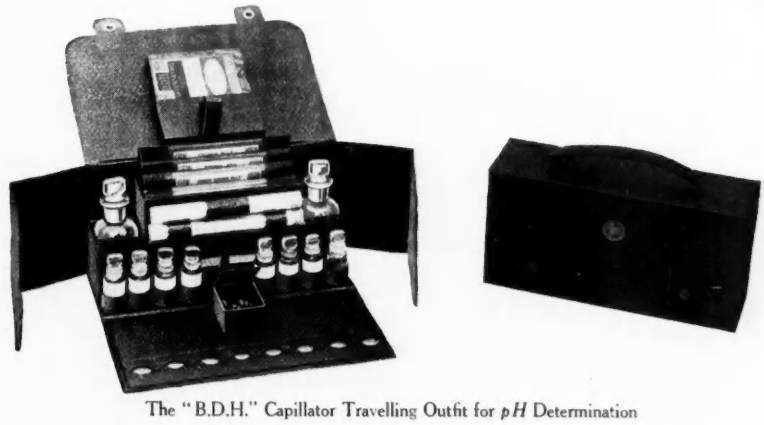
The figure 7 corresponds to neutrality; all values less than 7 represent acidity, and all values greater than 7 represents alkalinity, the strengths being indicated by the respective distances from 7.

Intermediate values are expressed as decimals and it may be noted that each increase of 0.1 in *pH* represents a 20 per cent. (more exactly 20.56 per cent.) decrease in H ions on the *pH* immediately preceding it. Thus:—

pH 0 = 1 gram of ionised H per litre.
,, 0.1 = 0.8 gram of ionised H per litre.
,, 0.2 = 0.63 gram of ionised H per litre.
,, 0.3 = 0.5 gram of ionised H per litre.



The "B.D.H." Comparator Case



The "B.D.H." Capillator Travelling Outfit for *pH* Determination

Acidity, Neutral Salts and Neutrality

The acidity of a solution depends entirely on the concentration of the ionised hydrogen. A strong solution of a weak acid (an acid that is only slightly dissociated in water) will have only a slightly sour taste; the concentration of H ions will be low, and therefore the *pH* will be high. Conversely, a comparatively weak solution of a strong acid (one that is almost completely dissociated in water) will have a very sour taste; the concentration of H ions will be high, and the *pH* will be low.

Great care is necessary to avoid confusion in regard to the term "neutral." Absolute neutrality has already been defined, but the word "neutral" is used frequently in another sense; for instance, a solution may be described as neutral to methyl orange or other indicators. In this case the word neutral is taken to mean that the solution will not completely change the colour of the particular indicator. The term "neutral salt" may also be somewhat misleading. In chemical nomenclature, a neutral (*i.e.*, normal) salt is one in which the whole of the replaceable hydrogen of the acid has

been replaced by its equivalent of a base. The reaction of such a salt will be neutral, acid or alkaline according to the strengths of the acids and bases concerned. Acids and bases of equal strength produce salts with neutral reaction. Strong acids and weak bases give salts which are acid, and conversely weak acids and strong bases form salts with an alkaline reaction.

The colour changes of indicators take place over definite ranges of H ion concentration; for example, methyl orange with a range from *pH* 2.9 to 4.0, is red when the concentration of H ions is not less than $10^{-2.9}$ (*pH* 2.9). With decreasing H ion concentration the colour of the indicator

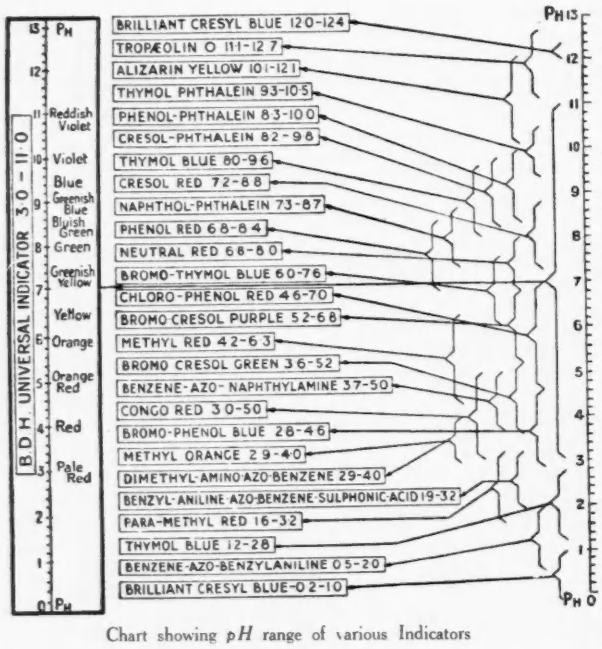


Chart showing *pH* range of various Indicators

changes towards orange until at a concentration of $10^{-4.0}$ (*pH* 4.0) the full yellow colour of the indicator is developed. No further change in colour will take place no matter how small the concentration of H ions may become. Methyl orange is therefore useless as an indicator over any range other than from *pH* 2.9 to 4.0. Similarly phenolphthalein will indicate only over a range from *pH* 8.3 to *pH* 10.0.

Each indicator has its own definite range which is usually expressed in terms of *pH*, the first figure indicating the minimum H ion concentration at which the full acid colour is developed, and the second figure the maximum concentration for the full alkaline colour; transition colours being shown between these extremes. Some indicators, however, have more than one range. Thymol blue (thymol sulphonephthalein), for instance, in a strong acid solution (*pH* = 1.2) is red, from 1.2 to 2.8 the colour changes through orange to yellow, and remains yellow from 2.8 to 8.0. At 8.0 the second change begins, and is complete at 9.6, when the colour is blue.

Buffer Solutions

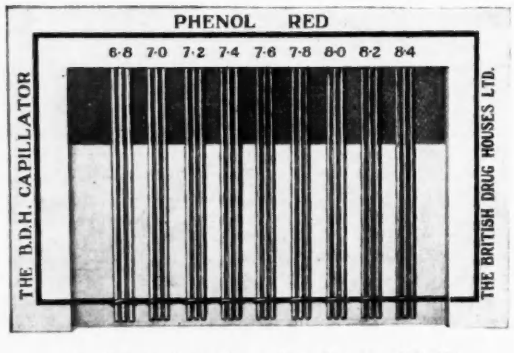
In order to determine *pH* values by the indicator method it is necessary to use standardised solutions of definite *pH* value for comparison. These are known as "buffer solutions" and are prepared from salts of weak acids and bases with varying amounts of acids and alkalies. They exhibit definite H ion concentrations, which, owing to the "buffer" action of the salts are not readily changed by traces of impurities, and they may be relied upon as standards. A solution of any required *pH* might theoretically be made by diluting a strong acid such as hydrochloric acid or a strong base (sodium hydroxide) with the requisite amount of pure water, but although this is quite practicable as regards 0.1N HCl (*pH* = 1.04) and 0.1N NaOH (*pH* = 13.07), it would be quite impracticable at dilutions of 0.000001N. Such solutions would be extremely sensitive to minute traces of alkali from glass containers and to carbon dioxide from the air, and they would not be reliable standards. It is therefore essential to employ salts which exert a "buffer" action, that is, salts which cause the change in H ion concentration on addition of acid or alkali to be very gradual.

Buffer tubes are sealed hard glass test tubes containing standardised buffer solutions to which a definite amount of an indicator has been added. A series of these tubes differing from each other in steps of *pH* 0.2 and each containing the same quantity of the appropriate indicator, will exhibit the whole colour range of that indicator. Such a series is known as a "set of buffer tubes" and nine or ten tubes are usually required to show the full colour range of the indicator. Under careful conditions of storage these solutions remain of constant strength, and the colours of the indicators keep for long periods, if they are not exposed to sunlight.

Determination of pH Values

The *pH* of solutions may be determined approximately by means of different indicators; thus a decinormal solution of ammonium chloride is alkaline to methyl orange (*pH* 2.9 to 4.0) and acid to phenol red (*pH* 6.8 to 8.4) consequently its *pH* lies between 4.0 and 6.8. It is found to be neutral to methyl red (*pH* 4.2 to 6.3), thus further narrowing the range. Its actual *pH* is 5.3. A quick determination can be made by using the B.D.H. Universal Indicator. This mixed indicator has a range from *pH* 3.0 to 11.0 with a colour change from red to violet in the spectrum order, each colour corresponding to a definite *pH*. The average observer can recognise the six spectrum colours and even their halfway shades with a fair degree of accuracy without the use of a colour comparison; thus a good approximation may be made by means of this indicator without the use of standard buffer tubes.

The *pH* of a colourless fluid can be accurately determined by comparing the colour produced on the addition of a suitable indicator with the colours in a set of buffer tubes containing the appropriate indicator. The procedure adopted is to add one drop of B.D.H. Universal Indicator to about 3 cc. of the fluid under examination and note the colour produced. Reference to the label on the bottle will then indicate the approximate *pH* corresponding to this colour. An indicator is now selected, the range of which corresponds to the approximate *pH* thus found and an accurately measured quantity of this indicator is added to the fluid contained in a hard glass test tube, and the colour is compared with a series of buffer tubes of known *pH* values each containing the same quantity of indicator. The *pH* of the liquid will coincide with that of the buffer tube having the same colour.



The "B.D.H." Capillator (Brit. Pat. No. 235,458)

Sealed buffer tubes containing the correct quantity of indicator may be obtained ready for use. Comparisons are best carried out by viewing the colours through the tubes against the light, the tubes being separated by black partitions. The B.D.H. comparator case has been designed for this purpose and also for the safe storage of sealed buffer tubes.

The Use of a Capillator

The "capillator" is a series of colour standards mounted on a white card. Each standard consists of three sealed-up capillary tubes containing the required buffer solution, to-

gether with a definite quantity of the indicator, and mounted touching each other on the card. The complete series therefore consists of a number of transparent stripes of colour about ¼ in. wide, each stripe marked with its exact *pH* value and varying slightly from its immediate neighbours: the whole illustrating the complete colour change of the indicator. The proportion of indicator in these capillary tubes is considerably greater than that used in the larger buffer tubes, so that the thin layer of liquid shows approximately the same depth of colour as that of the larger diameter test tubes. A slot is provided in the card so that by holding up to the light comparisons may be made by transmitted light, whereas by viewing against the white background of the card the comparisons are made by reflected light.

By this means very great accuracy is ensured, and as the whole series of colours is visible all the time the actual colour matching is carried out very quickly. In addition the amount of fluid required for a test is about one drop, consequently, it is invaluable for the determination of the *pH* of such liquids as urine, saliva, tears, plant juices, and other organic fluids.

To determine the *pH* of any liquid, it is necessary to choose a suitable indicator. A preliminary test should be made with B.D.H. Universal Indicator, and from the approximate *pH* thus found a suitable indicator chosen. To determine the exact *pH* a small rubber bulb is fitted to one end of a clean capillary tube, thus making a micro-pipette. The tube is filled as far as the graduation mark with the indicator solution, which is then transferred to a small watch-glass and then, without rinsing, the pipette is filled to the mark with the liquid to be tested, and this also is transferred to the watch-glass. The pipette is now re-filled with the mixed liquid and indicator, and the colour compared with the capillator standards. The strengths of the indicator solutions and the colour standards are so arrangegd that equal volumes of indicator and liquid are to be taken in all cases.

Some Industrial Applications

Many of the practical applications for hydrogen ion determination are discussed at length in "Hydrogen-Ions" by Dr. H. T. S. Britton (1929), in "The A.B.C. of Hydrogen Ion Control" by Dr. W. A. Taylor (1929), and in "The Measurement of Hydrogen-Ion Concentration" by Dr. Julius Grant (1930), while an extensive bibliography is given in Dr. W. Manfield Clark's book, "The Determination of Hydrogen-Ions" (1928).

In brewing each ingredient of beer has its own effect on the acidity, and, generally, the *pH* value at each stage in the production should be distinctly on the acid side. On the other hand, too great acidity is detrimental. It has been found by repeated experiments that *pH* values of 5.2 in the mash tun, 5.0 in the copper, and 4.2 in fermentation produce satisfactory results.

The corrosion of pipes and boiler tubes by the feed water used in steam and heat-raising plants is also largely influenced by the *pH* of the water. In general, the rate of corrosion can usually be minimised by so treating the water as to obtain a *pH* value of 9.5 or more. Condenser water should have a *pH* as near to 7 as possible. The control of *pH* is also important in refrigerating brines, in order to minimise corrosion of the brine pipes.

Slight changes in the acidity of the bath in electroplating and electrotyping may have a serious effect upon the appearance or properties of the deposited metal. Nickel plating solutions are usually maintained at a *pH* value between 5.2 and 6.8; in still tanks the best value is about 5.7, in barrel plating about 6.1, and for nickel electrotyping on wax about 6.6. Acid zinc plating solutions should be maintained at a *pH* of from 3.4 to 4.4.

The actual *pH* value for best results in leather manufacture will vary with the different tanning liquors employed. Bacterial activity can be reduced by maintaining the *pH* of the soaking water below 6.5 or above 8.0; the bating process is most effective at about 7.9, while the pickling solution should be maintained at approximately 1.5. In vegetable tanning the *pH* of the tan liquor varies between 2.5 and 5.5.

Accurate determinations of *pH* in cooking, bleaching, sizing, colouring, coating, water purification and other processes in paper and pulp manufacture, enable the manufacturer to obtain greater uniformity in his products and eliminate much wastage of materials such as aluminium sulphate and rosin size.

The keeping quality and other properties of milk depend, among other things, upon the hydrogen ion concentration. Normal fresh milk has a *pH* of about 6.5 to 6.65; with increasing *pH* there is a tendency for the specific gravity to decrease. By adding lemon juice to adjust the *pH* value of cow's milk to about 5.5, it is made more easily digestible by infants. The addition of hydrochloric acid to sour cream, reducing the *pH* to 3.0, enables milk fat to be easily separated.

In the manufacture of fruit jellies, jams and marmalades, the formation of jelly is effected by the *pH* value. The gelation optimum of pectin is at a *pH* of 3.0 and the optimum of pectase at 4.3. The sterilisation of canned foods is largely influenced by the *pH*, which also affects the flavour of the foods. Clarification, colloidal precipitation, colour and inversion of sucrose in cane sugar manufacture are also largely governed by the hydrogen ion concentration. In beet sugar manufacture it is advisable to control the *pH* of the liquors throughout the process of clarification, in order to secure the elimination of impurities. By controlling the *pH* of the liquors throughout the process of clarification, in order to secure the elimination of impurities. By controlling the *pH* of the pan liquors between 7.0 and 8.5, improved boiling operations and better quality of sugar may be obtained.

Textile Scouring, Bleaching and Dyeing

By controlling the *pH* in the wet processing of wool and silk, damage to the fibres is minimised, while effectiveness in scouring and in peroxide bleaching is also dependent upon the *pH*; in bleaching a hydrogen ion concentration of 10 has been found to give good results, with minimum wastage of the bleaching agent. Acid dye-baths may have a *pH* of about 1.5, while in alkaline dyeing good results may be obtained at from 10 to 11; the best *pH* value for any one dyeing solution, however, will depend upon other factors, such as the substances used in weighting silk. In the preparation and application of size to the warps, in desizing by acid or enzymes, kier boiling, hypochlorite and peroxide bleaching, mercerising, dyeing, and other wet processes, the quality of the product can be rendered more uniform, and frequently much wastage avoided by means of *pH* control.

In water purification the most efficient coagulation has been found to occur at a definite *pH* value, which, however, differs for different waters. The optimum *pH* for the majority of waters, using alum for coagulation, generally lies between 5.5 and 7.0. Accurate determination of the optimum *pH* enables a good and quick floc to be obtained with the minimum quantity of alum, or other chemicals, thus avoiding waste; it also eliminates solvent action, ensures a high bactericidal efficiency, increases the rate of filtration, and enables a smaller coagulating basin to be employed.

Monel-Weir Merger

Organisation Transferred to London

FROM October 1 the business of Monel-Weir, Ltd., of Glasgow, has been transferred to Henry Wiggin and Co., Ltd., whose head office is at Thames House, Millbank, London, S.W.1. The organisation of Monel-Weir, Ltd., has been merged with that of Henry Wiggin and Co., Ltd., and the combined businesses will be conducted by, and in the name of, the latter company from its offices in London. Mr. J. Ireland, managing director of Monel-Weir, Ltd., and his principal assistants will be located in London on and after October 17, and will be responsible for the sales of monel metal, thereby preserving the continuity of the business. Monel-Weir, Ltd., is in voluntary liquidation from October 1.

For some time monel metal has been produced at the Birmingham works of Henry Wiggin and Co., Ltd., where up-to-date plant has been installed for the purpose of producing numerous types of nickel and nickel alloy products. Monel metal tubes, turbine blading, castings, etc., will continue to be manufactured as hitherto. The joint experience of the two companies should help to promote the development of the use of nickel and its alloys in industry generally. Branch offices of Henry Wiggin and Co., Ltd., are situated as follows:—Wiggin Street, Birmingham; Arundel Street, Sheffield; 22 St. Mary's Gate, Manchester; and 108 West Regent Street, Glasgow.

Chilean Nitrate Production Costs

A Comparison of the Shanks' and Guggenheim Processes

THE second portion of the official report on Cosach, which was drawn up in Chile and has now been published, throws important light on the relative costs of the Shanks' and Guggenheim processes. It is stated that the productive capacity of the nitrate industry in the year 1929 amounted to about 3,500,000 metric tons, of which about 500,000 tons could be produced in the only Guggenheim plant existing at that time, and 3,000,000 tons in about 70 plants of the Shanks' type. Of the Shanks' plants the productive capacity varied from 150,000 tons per year down to 20,000 tons and less. Most of the plants were old-fashioned and inefficient, but there existed a number whose superior organisation gave good results. The ten cheapest Shanks' producing plants had a capacity of 500,000 tons annually, with a minimum cost per ton on drying floor of $78 and a maximum of $114. Other less efficient producers accounted for the balance of the output with costs running higher, but these costs could have been appreciably reduced by modernisation, centralisation of production in larger installations, and the exploitation of virgin deposits near the working plants.

The figures presented in this report have been capaby analysed by "The Financial News." It is pointed out that the Guggenheim plant of the Anglo-Chilean Consolidated Nitrate Corporation commenced its operations in November, 1926, and by the end of 1929 the balances of this company showed a deficit of nearly $11,000,000 U.S. gold, in spite of a much higher sale price for the nitrate produced than that obtained by the Shanks' plants. During 1929 the Maria Elena plant produced 383,800 tons per year on a monthly average of 32,000 tons. The average cost of granulated nitrate for nine months (June, 1928 to March, 1929) was $117.80 Chilean pesos per ton, compared with Shanks' figures as follows:—

Shanks.—380,000 tons capacity. Cost, mean average of best plants, $99—on drying floor, ready for sacking.

Guggenheim.—380,000 tons capacity. Cost, mean average nine months, $117.80 granulated, ready for sacking.

The "on costs," due to amortisation of plant, grounds and equipment, and to interest and amortisation on capital investment, are infinitely higher in the case of the Guggenheim plant than in the Shanks plant. Including the secondary costs of 45 pesos per ton from drying floor to the coast, the full cost for the year 1929 is as follows:—

	Capacity tons.	Cost f.a.s. per ton $.
Guggenheim	383,000	297.20
Shanks	380,000	205.94
,, ...	1,343,000	225.60
,, ...	2,163,395	235.84

Value of Patents

The economy produced by the Guggenheim process, when normal working conditions were attained, was assured to be $40.00 Chilean currency per ton (£1) against the Shanks' process, and on that basis the value of the patents was calculated at £7,500,000, and transferred to Cosach at that price. "We are in a position," continues the report, "to give the official costs of the only two Guggenheim plants in existence, during a period of nine months, from July, 1931, to March, 1932, and to compare them with the equally official costs of three Shanks' plants during the same period of nine months, all five plants working under the Cosach (Guggenheim) administration." These two Guggenheim plants are among the most modern installations in the world in any industry, and are installed in virgin grounds, exploiting those parts of them which are peculiarly suitable for mechanical mining, while of the three Shanks' Oficinas working under Cosach administration, the Chacabuco of the Lautaro Co. commenced production in 1922, but was installed in grounds exploited for at least 30 years at the time. Santa Luisa has been worked for at least 40 years and its plant and equipment are of a very secondary order. Peña Chica is equally old, although it has been somewhat modernised, and is taking advantage of a patch of favourable virgin ground.

The comparison is entirely unfavourable to the Shanks' plants in regard to installation and pampas, and yet the costs do not reflect any superiority on the part of the Guggenheim process, installed under these entirely favourable conditions. The costs given do not include capital charges of any kind nor charges for depletion of grounds nor plant amortisation. According to the official figures, the cost of manufacture over a period of nine months up to March, 1932, using the Guggenheim process, to produce 671,027 tons of nitrate, amounts to 890.54 Chilean currency (£2 5s. 3¼d.) per ton, while over a production of 207,850 tons in the Shanks' plants a cost of $101.76 Chilean currency was attained (£2 10s. 10½d.), showing an advantage of Guggenheim over Shanks of 5s. 7¾d. per ton, and not £1 per ton, as claimed.

The official figures show an arbitrary distribution of the overhead charges for administration in Chile (North and South) and abroad (New York), Maria Elena being charged with $6.79 per ton and Pedro de Valdivia with $7.47, while Chacabuco, Santa Luisa, and Peña Chica appear with $13.42, $13.33, and $14.09 respectively per ton. An equitable redistribution of these charges among the total tonnage produced, results in a charge of $8.73 per ton in all oficinas, and this correction, perfectly justified, brings the Guggenheim cost up to $92.10 (£2 6s. 6d.) per ton, reducing the Shanks' cost to $96.72 (£2 8s. 4½d.) per ton, showing an economy in favour of Guggenheim of only 1s. 10½d. per ton.

With freight at 24s. per ton and insurance, commissions, etc., at 6s. per ton, sales commissions and propaganda equal to 10s. per ton, nitrate can be placed in European ports at £4 7s. per ton, without allowing for depreciation of plant and amortisation of grounds. These items, on a production of, say, 100,000 tons annually, could easily be covered by £1 per ton, making a total cost of £5 7s. per ton. Such figures, comments "The Financial News," make a happy showing for the nitrate industry, even with low sale prices in consumer's ports, especially as the Chilean Government is disposed to abolish its duties and receive half of the producers' profits.

Production Charges

Cosach capital charges, however, make business entirely impossible, for even supposing the above basic costs were available to this company if it concentrates on Shanks' plants, and abandons the Guggenheim system, the charges on Cosach production of 1,000,000 tons amount to at least $30 U.S. per ton, making a total cost in United States gold of:—

£4 7s. at $3.50 U.S. per £ . . . $15.225 U.S. gold.
Charges ahead of common stock . . 30.000 U.S. gold.

$45.225 per ton.

with a sales price of possibly $30 to $32 U.S. per ton in consumer's port, without covering depletion and amortisation.

One of the important claims made in favour of the Guggenheim process as against the Shanks is that the former facilitates an extraction and production of more than double the quantity of nitrate otherwise obtainable from a given deposit. It is possible that a slightly higher efficiency of extraction, by mechanical mining methods, might be obtained as compared to the old hand selection methods hitherto used, but this is not to be taken as a general statement.

The application of the Guggenheim process is strictly limited in the nitrate industry: (*a*) to large groups of grounds with sufficient caliche within a radius of, say, 20 kilometres for a life of twenty years, for a plant of minimum capacity of 500,000 to 750,000 tons per year, or a total of 10,000,000 to 15,000,000 tons, and (*b*) the deposits must be fairly homogeneous and not too broken up or patchy, not too undulating in themselves and not contained in undulating pampas.

Overhead Charges

The enormous overhead charges of Cosach, it is stated, renders it impossible for that company to produce nitrate and to pay its way. In order to do so, without considerating a

profit on its ordinary share capital, three-fifths of which represent the Chilean Government's interest in the business, and without allowing for depletion of grounds and amortisation of plant, it is necessary to produce 2,500,000 tons of nitrate annually at a cost of $16 U.S. per ton free alongside of steamer in Chilean port, and to sell that quantity at over $28 U.S. in Chilean port, equivalent to $33 to $34 U.S. per ton in consumer's port, not allowing for sales commission and propaganda. So as to provide a 7 per cent. dividend on all the Ordinary shares, which would produce $105,000,000 Chilean currency of sixpence per year for the Chilean Treasury (as against the $250,000,000 produced by the export duty in former years), the sales price for 2,500,000 must be at least $8 U.S. per ton more; still without covering depletion of grounds and amortisation of plants.

A sale price of, say, $42 U.S. per ton in consumer's port, combined with a consumption of 2,500,000 tons, is quite outside the realms of practical possibility, and, so that Cosach be enabled to continue its operations, a thorough reconsideration of its financial organisation is absolutely necessary. On the basis of a possible sale of 1,500,000 tons per annum, a sale price of $29 U.S. per ton, f.a.s., and a cost price of $15.40 U.S. per ton, f.a.s., including profit on iodine and the Tocopilla Railway, a reduction of at least 75 to 80 per cent. of Cosach obligations, is required, and this reduction would permit the business to cover expenses and to provide $70,000,000 annually for the Chilean Government. Even then the scope of the nitrate business will be strictly limited, unless the Guggenheim system is abandoned, or, at least, unless future developments are based essentially on the rationalisation of the Shanks' plants, without further extension of the Guggenheim system.

Some Difficulties in Cotton Yarn Mercerisation

Troubles Revived by a Change in Fashion

DIFFICULTIES in cotton yarn mercerisation which were revived by changes in fashion were referred to by Dr. Paul Krais, of the Textile Industries Research Institute, Dresden, in the course of a paper which he read at Manchester on the occasion of the discussion on colloids and textiles organised by the Colloid Committee of the Faraday Society.

According to Dr. Krais it has been known for twenty-four years that mercerised cotton behaves differently in the dye-bath according as to whether it has been dried or not between the mercerising and the dyeing process. E. Knecht, who was the first to announce this fact in 1908, stated that cotton yarn, mercerised under tension, takes up the following amounts of Benzopurpurine 4B :—

Not dried	3.24 per cent., cal. in parts :	100.0
Dried in the open air	3.03 per cent., cal. in parts :	93.8
Dried at 110° C.	2.51 per cent., cal. in parts :	77.5

Need for Repetition of the Mercerising Process

No difference was found in the case of ordinary cotton, whether it was dried at 110° C. or not, before dyeing. Knecht also observed that the alteration which mercerised cotton undergoes on drying is a complete one, not being reversed even by prolonged treatment with running water or dilute acids or alkalis. Repetition of the mercerising process is the only means of curing such faults as are caused by irregular drying between mercerisation and dyeing . This knowledge has been well kept in mind by all mercerisers and textile chemists, so that serious faults have occurred but rarely. Recent changes in fashion during the last two or three years, however, has brought up this difficulty afresh. Short skirts have given stockings an importance hitherto unknown. The fashionable stocking shades were very light salmon, orange, drab and silver, and in order to dye these the stockings has to be well boiled out and bleached before dyeing. But the second change of fashion has brought about a demand for dull brown, and dark greys exclusively so that boiling out and bleaching is now superfluous. This means that every minute difference in the mercerised cotton yarn shows now itself by unevenness in dyeing, the faults taking varied forms, such as ringlets, lighter or darker bars and spots.

In all there are about thirty possibilities which may cause uneven dyeing in mercerised cotton hosiery, the three chief factors being (1) difference in drying, (2) traces of mineral acid, (3) influence of light and air.

Effect of Different Degrees of Drying

The faults caused by different degrees of drying have been mentioned above, but new data has become available, which confirms and expands E. Knecht's statement. It seems that the highly swelled condition of the cotton fibre after mercerising and washing is most favourable for the taking up of direct dyestuffs, and that in this condition is reduced permanently and in degrees by drying at different temperatures. An intermediate state is reached if we dry at 50° C. There is, so to speak, a de-swelling formation, which is dependent on the drying temperature, independent of consequent wetting out, independent also of whether the cotton has been mercerised under tension (Knecht) or without (Krais).

Influence of Traces of Mineral Acids

The second point is, that minimal traces of mineral acids can have a very marked influence, even after they are completely removed. Mercerised cotton is quite absurdly sensitive in this respect. When a hank of mercerisd cotton is impregnated at ordinary temperature with N/500 hydrochloric acid and squeezed out, it contains about 0.013 per cent. HCl. If this hank is dried at 100° C., washed thoroughly in alkaline water and dyed (Diamine Black BH) in the same bath with a non-treated hank of the same mercerised yarn, there is a difference in shade, which is sufficiently stong to make goods unsaleable. With N/1,000 acid no difference is to be seen. The result of this is that the merceriser must be very careful to leave no trace of acid in the yarn that goes into the drying oven. The question is whether these different dyeing properties are caused by superficial formation of hydrocellulose, or by a change of the isoelectric point, or by some other change.

The third difficulty, change by light and air, is more difficult still. Mercerised cotton yarn, when stored in bundles, the ends of which are exposed to light, will change by the fading of the natural brownish dyestuff, which is characteristic of Egyptian cotton. This will, under modern conditions (no boil, no bleach, brown shades), lead to uneven dyeings, but there seem to be some subtler influences also, of which we have no knowledge yet. Mercerised cotton in the raw state is a very sensitive material, the study of which is most interesting, difficult and incomplete. During mercerisation a new cellulose compound, sodium cellulose, is formed and decomposed again, and great swellings and contractions take place.

New Fauser Nitrogen Fixation Plants

THE Société Establissements Kuhlmann has just completed at Lille a plant for the production of ammonium nitrate by the Fauser process, with a capacity of 70 tons per day of 35 per cent. nitrogen salt. Furthermore, the Société Potasse et Engrais Chimiques, owned by the State potash mines in Alsace, has begun building an ammonium nitrates plant at Grande-Couronne, which will have a daily productive capacity of 40 tons. The Société de la Grande Paroisse, operated by the Société St. Gobain e Air Liquide, is also putting up an ammonium nitrate plant on the Fauser process at Lieven, which will have a daily capacity of 25 tons.

The Scandinavian Market and the Copenhagen Exhibition

By SIR ERNEST BENN

I DO not remember a more pleasing experience than my visit last week to Denmark and the Copenhagen Exhibition. Exhibitions have always interested me; there is an atmosphere and enterprise and push associated with them which is hard to find in any other connection. It may simply be that the collecting together of a few hundred sellers and a few thousand buyers, and the multiplication of the commercial spirit in this way in the one big mass, makes more evident the forces which are at work all the time in every market, however small. But this Copenhagen Exhibition cannot be compared with any other in my recollection. So far as I know every exhibition in history has been promoted by the sellers, the advertising has been done by the exhibitors, and the buyers have been invited, cajoled, pressed or persuaded to put in an appearance. Such festivities as invariably form part of an exhibition undertaking have always been paid for by the sellers or the exhibitors, and the buyers have always been the guests and generally the objects of lavish hospitality.

With Copenhagen everything in this usual and natural scheme was reversed. The buyers organised the exhibition, accepted full responsibility for it, invited the sellers to display their goods, made every conceivable arrangement for their reception and comfort, and treated them throughout as honoured guests. Import unions, merchants' federations, agricultural councils and other bodies which throughout the history of commerce have never spent a penny on trying to sell anything, poured out their funds on this great national effort to sell the wares of another nation. Thus it will be seen that Copenhagen was a rather refreshing experience to those commercially minded persons like myself who had the privilege of being there last week and participating in this most exceptional enterprise.

A Business-like Scheme

It must not be imagined that some big psychological change has suddenly descended upon the earth and chosen Denmark as the favoured spot to begin its operations upon mankind. The Danes are not fools, are not over-blessed with altruism, and have not suddenly decided to adopt the rôle of benefactors of the British nation. The whole scheme is thoroughly business-like in its conception, and the novelty of it arises solely from the fact that the Danes, following the example of a year ago in the Argentine and improving upon that experience, have been the first to recognise the exceptional needs of the commercial situation, and have found a way to meet them.

Denmark is an agricultural country. It is one of the freest countries in the world to-day, although that is not saying very much when one remembers the general freedom of the pre-war days. It is not an agricultural country in quite the same sense as any other that I know, for its agriculture is based upon imported cereals. It has carved out through a century of experience a trade of its own. It does not attempt to do very much in the growing of wheat, but imports cheap wheat as its raw material from every market in the world, uses the imports to feed cattle and pigs and chickens, and specialises on the production of the highest grades of bacon and eggs. When, therefore, we buy bacon from Denmark it is an error to assume that we are buying a wholly Danish product. The transaction is really concerned with the finished article which is made of imported material coming from America, Canada, the Argentine or Russia as the market may dictate.

Anglo-Danish Trade

But the fact remains that, looking at the figures of Anglo-Danish trade, Denmark has sold to this country for many years past a great deal more than she has bought from this country. Her sales to us have been three and four and even five times as much as her purchases from us. Aggressive German salesmanship and geographical proximity have led Denmark along the road of least resistance, and her requirements in manufactured merchandise have been very largely supplied from Germany. To get the picture complete and into its proper perspective it is necessary to realise that this large German import business has never really been welcome to the Danes. The history of Schleswig-Holstein is still in their memories. Germany even in her present distressed condition is the big powerful menacing neighbour to a little kingdom of a few thousand inhabitants, and no love is lost between Germany and Denmark. The same considerations apply in slightly different form to the trade between Sweden and Denmark, and although Sweden has developed her industries to a much greater extent than has Denmark, the import of Swedish machinery and manufactures generally is a matter of convenience and not of sentiment with the Dane. On the top of all these considerations comes the new found determination of the British commonwealth of nations to develop trade with one another, and out of them all arises this wholly delightful recognition by the Dane of the necessity for buying our goods. That in brief is the story of the Copenhagen Exhibition.

But Copenhapen and Denmark must not be considered alone. They are to some extent typical of all the Scandinavion countries. Sweden is at this moment busy following the Danish example. Norway is in a better position because she does maintain a better balance of trade with us. Finland, with a new found independence, is full of desire to get away from European entanglements and to take her part in northern European trade with England as the predominant partner. Thus the whole of this part of the world offers opportunities for British enterprise, of which our manufacturers are only just beginning to be aware.

Influence of the Prince of Wales

The Prince of Wales, of course, has done more than anybody else could do to put the finishing touches on to this very hopeful situation. His efforts on behalf of British trade put most of our merely commercial people to shame. For a week in Copenhagen he displayed an energy and enthusiasm in the advertising of British goods which put new heart into those Britishers who were fortunate enough to come into contact with him.

As to the Exhibition itself the five hundred firms who participated are to be congratulated on their enterprise. Owing to the lukewarm, half-hearted attitude of the Federation of British Industries and the Department of Overseas Trade it cannot be claimed that we made a show that was really worthy of us. It was only when the doors of the Exhibition were actually open, and when the whole Danish nation turned out to welcome the Prince of Wales, that we realised either the importance or the possibilities of the enterprise. Nevertheless the five hundred firms who were there gave a good representative display of British products. The display was all the better because of the close co-operation with Danish importing firms. Most of the stands were in the charge of Danish agents, and displayed the products of a number of different manufacturers, with the result that from a buyer's point of view business was all the easier. It now remains for manufacturers generally to follow up the splendid impression which has been created by the despatch of personal representatives, to give to Scandinavia something like the attention which they have been accustomed to receive from our commercial rivals in the past.

Notes on the Principal Exhibits

DENMARK is dependent for her supplies of coal, coke, and many kinds of chemicals upon foreign countries. The coal and coke is bought mainly from Great Britain, but in recent years large quantities have also been imported from Poland and Germany. Normally large quantities of fertilisers, such as raw phosphate and superphosphate, are imported, the co-operative societies alone purchasing about 125,000 tons annually. Caustic soda and calcined light alkali come from Great Britain and Belgium, potash and caustic soda mainly from Germany, copper sulphate in about equal quantities from Great Britain and Germany, and acetic acid almost exclusively from Germany. Fine chemicals are also imported mainly from Germany. During the last three years—1929-31

the imports of coal from Great Britain has steadily declined in volume and in value. In 1930 Denmark bought 744,145 tons of coke and manufactured fuel valued at £749,809, and chemical manufactures and products other than drugs and dyestuffs to the value of £79,785, from the United Kingdom.

It is therefore a pleasant surprise to find that certain firms of British colliery owners have appreciated the opportunity presented by the Copenhagen Exhibition to extend the sales of their products in Denmark. In the past it may have been true that British coal sold itself, but with the development of coal mining in other European countries, and the introduction of competitive forms of fuel, conditions have entirely changed on the world's markets. It is doubtful whether the rival forms of fuel would have established such a strong position if the interests behind them had not appreciated the value of modern forms of publicity, and it is therefore welcome to discover that their value is at last being recognised by British colliery owners.

Display of Beckton Coke

An exhibit which cannot fail to attract much attention is that of Cokemart, Ltd., which is associated with The Gas Light and Coke Company. Its main feature is a working model which shows Beckton coke being carried from London to Copenhagen and Danish produce being brought back on the return journey to London. A scale, moving all the time and heavily balanced in favour of Denmark, points the moral. In panels at either end of the moving hands are silhouettes of London and of Copenhagen, and large coloured maps of England and Denmark behind the panels give a finished appearance to the whole model, over which the main message is "Buy Beckton coke and help to adjust the trade balance." There are two simple diagrams on the outside wall, one showing all the stages of production in a gasworks and the other showing that one ton of coal treated in a gasworks gives 8,400,000 heat units, 9 cwt. of coke, 11 gallons of tar, 25 lb. of fertiliser, and 80 lb. of ashes, whereas treated in a modern electric generating station it gives only 6,000,000 heat units plus 224 lb of ashes. Appropriate literature is supplied, and this is in Danish, as is all the wording on the model.

Another interesting exhibit is provided by the Consett Iron Co., Ltd., which claims to be the largest shipper of patent coke from Britain. Its display embraces samples of their coke, coke nuts and gas, coking and steam coals, together with samples of their silica bricks. The name "Consett," it is stated, is known not only in Denmark but also in the other Scandinavian countries, which purchase large quantities of their products. The Newcastle-upon-Tyne and Gateshead Gas Co. is showing gas-coke made in vertical retorts and gas coke and coke nuts made in horizontal retorts. According to a statement by this company, the coke is made from the best Durham coal and is lighter and yields a greater number of hectolitres to the ton than the patent oven-coke, while the product of the vertical retort is lighter than that of the horizontal retort and gives a still greater number of hectolitres to the ton, the hectolitre being the unit of measurement normally adopted for fuel in Denmark. The company's exhibit is also of interest to the industrial chemical industry as it includes samples of benzol, naphtha, creosote, carbolic and cresylic acids, naphthalene, pyridine, and pitch.

Salt, Insecticides and Paints

Among the representatives of the chemical industry of Great Britain are the Salt Union, Ltd., whose chief interest in the Danish market is the bacon curing industry, to which it supplies annually thousands of tons of salt and nearly all the chemically pure salt which is comsumed. The exhibit consists of bacon curing salts, both for brine and sprinkling, in the form of special common salts from Liverpool and Middlesbrough and its "Triple Triangle" brand of chemically pure salt which carries on the dry sample some 99.97 per cent. of sodium chloride. The same salt is also shown in a dried condition for domestic and table use, a model of a waterfall, in which the salt takes the place of the water, demonstrating its free flowing qualities. In addition, there are on view small facsimiles of the bags supplied to agents and barrels bearing special marks; attractive cartons, flasks, and pourer drums containing the company's special iodised vacuum salt, for which there is, as yet, no market in Denmark: a map showing the extent of its salt fields in Great Britain, and photographs of its Danish works.

Of special interest to horticulturists is the exhibit of the Murphy Chemical Co., Ltd., which comprises a range of insecticides and fungicides, among them a special tar oil winter wash, which is stated to be extensively used by commercial fruitgrowers for the destruction of insect eggs on dormant fruit trees.

Interesting displays are also made by manufacturers of paints and varnish, including Llewellyn Ryland, Ltd.; the Walpamur Co., Ltd.; British Glasurit, Ltd.; and Docker Brothers. Robbialac paints and varnishes, which are manufactured by Jenson and Nicholson, Ltd., are exhibited on the stand of Stevens and Co., of Copenhagen, who are their agents.

Diphenyl in the United States

Manufacture and Applications

ALTHOUGH mentioned as far back as 1876, diphenyl has only sprung into importance within the last two or three years. In the United States it has now been placed upon the market in large quantities by the Federal Phosphorus Co. The manufacturing process adopted by this firm, is one in which liquid benzol is passed into a narrow coil which is heated to 650° C., while the actual reaction when two molecules of benzole condense together takes place in a second vessel maintained at 725° C. Continuous working is a feature of the process, the success of which depends to some extent upon rigid adherence to the optimum temperatures. Condensation of the diphenyl vapours to the liquid state is effected by rapid cooling, any unchanged benzol being then distilled off and returned to the pre-heating coil. The by-product hydrogen is utilised for metallurgical purposes.

Advantages as Industrial Heating Medium

Pure diphenyl has a density of 1.16, a melting point of 69.2° C. under 745 mm. pressure and a boiling point of 254° C. According to H. Pincass ("Chemiker-Zeit.," September 28, 1932), qualities which promote its use as an industrial heating medium are its low vapour tension, high critical temperature, high latent heat of evaporisation, high resistance to high temperatures and high specific molecular heat. Whereas water possesses a vapour tension of 45.5 at 255° C., that of diphenyl is represented by the remarkably low figure of 1.1, and the difference is even more marked at higher temperatures, the respective values at 316° C. being 126.1 and 3.4. The substitution of diphenyl for superheated steam in industrial heat transmission opens out the possibility of attaining higher temperatures with a much less elaborate plant than has hitherto been found practicable. Among the tested application of the thermal value of diphenyl are (1) the evaporation of caustic soda lye whereby concentrations of 98 per cent. caustic soda have been obtained, and (2) the melting of asphalt which requires a temperature of 177°-246° C.

Among the derivatives of diphenyl, the pale-coloured chlorinated products which range in character from viscous liquids to hard solids appear to possess possibilities as plasticisers and resins in the lacquer industries. Under the name of "aroclors" they are already in extensive use in the United States, where the water- and alkali-resistance and relative non-inflammability of the linseed oil varnishes containing an aroclor as the resinous ingredient is opening up a wide field in the decorative industries. Aroclors have also been found to render good service as impregnating agents for woodwork as well as for the preparation of waterproof paper and building stone.

Australian Chemical Trade

AGENTS for heavy chemicals in Australia report improvement in their advance orders, covering chemicals usually delivered around the end of the year. One large distributor of industrial chemicals stated that the five weeks ended June 30 was the best of any similar period. The improvement in orders is attributed in part to replenishing stocks and it will require a lapse of time to determine whether improved buying is permanent.

Reducing the Dye-House Costs

Use of All-Metal Dye Kettles

This article is reprinted from a recent issue of the "American Dyestuff Reporter." It is based on the results of co-operative experimental work carried out by a prominent manufacturer of dyeing and finishing machinery and one of the leading dyestuff manufacturers. A long series of tests involving some two hundred or more of the acid mordant dyes showed that only six of these dyes were effected at all by nickel and only one was seriously affected.

NOT only in fulling, washing, stock and tenter drying and cloth carbonising has equipment made tremendous strides during the past two years. There are now available new, all-metal piece dye kettles, that largely eliminate costly repairs and up-keep, and that enable dyers to process cloth uniformly and continuously at the highest possible hourly production compatible with quality standards. These modern units, as built by one manufacturer, are constructed of pure nickel, hot-rolled on steel, or of chrome nickel, depending upon dyeing requirements.

All dyeing operations have certain definite technical requirements and certain commercial requirements. The chief of the technical requirements are (a) to dye quickly and with true, full and uniform shade: (b) to effect this condition within a minimum of effort. Commercial requirements are (a) to dye continuously with minimum loss of time between colour changes; (b) to attain qualiy production at reduced cost per yard per dyestuff, labour, attendance and upkeep; (c) to operate continuously without shut-down and subsequent loss of labour, time and output: (d) to dye without risk of cost of seconds for re-dyes.

Development of the All-Metal Kettle

To meet these requirements, various equipment is available. These units have essential differences, which eventually affect commercial requirements and plant profit. The history of the development of the all-metal kettle, as built by the manufacturer, and the reasons given for the choice of nickel and chrome nickel are interesting. Beginning some four years before the announcement of the first all-metal machine, engineers of this machinery manufacturer, working with outside chemists and metallurgists, began to experiment with porcelain, hard rubber, stainless steel, monel, nickel and chrome nickel as possible materials for dye tub fabrication. For various good reasons, some involving cost, and some involving non-workability of product, these engineers discarded the idea of using porcelain or hard rubber and confined themselves to an examination of the four metals—nickel, chrome nickel, monel metal and stainless steel alloys.

It was found, however, after a long series of tests that nickel, chrome nickel and stainless steel could be used equally as well in so far as trueness of shade was concerned in dye tub construction, but even then, there were essential differences. For example, nickel, hot-rolled on steel, afforded tremendous advantages in construction, because, due to the type of metal, that is, nickel hot-rolled on steel, it was possible to fabricate a kettle eliminating the need of heavy frames and numerous tie rods, braces and battens, such as are necessary, to support the stainless steel sheet when formed into dye tubs. It was further found that it was impossible to weld stainless steel sheets without welding heat changing the intercrystalline structure of the alloy steel and seriously injuring, or completely destroying, the corrosion resisting properties of the stainless steel around the area of the weld. Welding methods produce localised precipitation of carbides which not only impair corrosion resisting properties but cause marked loss of tensile strength and embrittlement of the stainless sheets. For these reasons, then, the machine builder turned to self-sustaining pure nickel, hot-rolled on steel and chrome nickel.

Advantages Offered

The main body of the nickel all-metal kettle is fabricated of pure nickel, hot-rolled on steel, or of chrome nickel. This type of construction is self-sustaining, corrosion proof, wear-proof and impervious to dyes. In addition, the front partition and the false bottom of the tub when supplied, are fabricated, also, of pure nickel or chrome nickel. The kettle, moreover, is equipped throughout with roller bearings, heavy duty roller chain. The main reel, whip roll and delivery roll are made of pure nickel or chrome nickel. Splash boards and hand rods, combination rubber and nickel drain plugs are likewise of pure nickel or chrome nickel. In some instances, hand wheel adjusted rubber squeeze rolls are furnished as an extra, depending upon the requirements.

As to the advantages of this construction when measured against the initial cost, in the first place all-metal kettles eliminate completely the need of "boiling out" which in wooden kettles is a tremendous time consumer. In the metal kettle, a quick rinse is all that is required in going from the darkest to the lightest shade and back again. That. in itself, is an economy and an impetus to production. Secondly, as wood is eliminated completely, there can be no risk of colours bleeding ot of the porous fibres to affect subsequent colours, thus there can be no risk of re-dyes or seconds. There is nothing to rot or leak, and nothing to replace.

Unquestionable Proof of Permanence

The proof of the permanence of all-metal kettles and of the reasons why they mark the end of wooden machines may be seen in a statement made a few weeks ago by two of the largest producers of woollens and worsteds in the United States. Both of these principals said that after witnessing the advantages of the all-metal kettle, no mill. in their opinion, cold afford to install wooden machines in the future.

Investigations of metals in combination with dye liquors has demonstrated that nickel, stainless steel and chrome nickel were in general equally suitable for dye tub construction, so far as trueness, fullness and brightness of share are concerned. To demonstrate this, an independent textile chemist carried out a long series of tests on nickel, chrome nickel, stainless steel. nichrome, monel metal and glass, using, among others, chrome acid dyes and acid dyes. In making these dye tests, the dye solution for a given colour was made up all in one batch to show uniformity, and measured identical quantities of this dye liquor were used; care was also taken to insure that the same weight of cloth was run in each beaker. The dyeings were made at the boil, and the liquid levels were maintained constant in the respective beakers throughout the operation by the addition of hot distilled water for makeup. From the results of these tests, he stated, there was no available evidence that any one of the three metals (nickel, chrome nickel and stainless steel), is more satisfactory than the other, with all factors considered, for dye tub construction. Furthermore, a list of over 200 mordant acid dyes recently studied by a leading dyestuff manufacturer showed that less than six dyes were at all affected by nickel and of these only one was seriously affected. Where this one type of dyestuff is encountered, it is singularly easy to solve the problem by the use of chrome nickel instead of nickel in the all-metal kettle.

New Alcohol Motor Fuel of Foreign Origin

THE Deutsche Gasolin A.G., Leunawerke, has recently added a new alcohol motor fuel mixture to the many fuel blends now on the German markets. The composition of the blend is given as 78 per cent. Leunawerke synthetic gasoline and 22 per cent. alcohol. The increasing number of alcohol blends is attributed to the required purchase of alcohol equal to 6 per cent. of other motor fuel materials used. It is expected in trade channels that this percentage may be increased to 10 per cent., being effective as from October 1.

Linseed Oil Production in Canada

OFFICIAL data indicate eight linseed oil manufacturing plants operated in Canada in 1931—three in Quebec, two in Manitoba, two in Ontario, and one in Alberta, possessing a total capital investment of about £540,000. Their combined linseed oil production in 1931 totalled 4,149,807 gallons, valued at £560,000, as compared with 5,128,889 gallons, worth £1,000,000 in 1930.

Lithium and Lithium Salts in Industry

A Wide Variety of Possible Uses

INFORMATION on the uses of metallic lithium and lithium salts, the sources of lithium minerals, production and marketing, are given in a report issued by the Imperial Institute (H.M. Stationery Office, price 6d.).

This report is one of the series on the mineral industry of the British Empire and foreign countries, which was originally started by the late Imperial Mineral Resources Bureau.

Lithium chloride, the parent salt from which the metal is prepared, was until recently usually made by calcining the powdered mineral (generally amblygonite or spodumene) with a mixture of ammonium chloride and calcium carbonate, extracting the mass with water and hydrochloric acid, and then evaporating the solution to dryness. The economic production of lithium chloride from the crude minerals has hitherto been difficult and the methods adopted involved the use of materials rich in lithium.

Preparations of Metallic Lithium

A considerable advance towards the cheap production of metallic lithium resulted from the researches started during the war by the Metallgesellschaft A. G. of Frankfurt-am-Main. This work had for its object the finding of a substitute for tin in certain alloys, and lead to the discovery of some important properties of lithium, but the requisite supplies of the metal for making large-scale experiments were not immediately available. As large quantities of high-grade lithium minerals were not then obtainable in Germany, the organisation turned its attention to the evolution of a simple method for reducing the metal from low-grade lepidolite-rock, containing only about 1 per cent. of lithium, of which abundant supplies were to be had in the Harz Mountains. A full account of the research work carried out in this connection has been given by Von Girsewald ("Metallgesellschaft Periodic Review," 1929, No. 2, 13). Briefly, the process consists in the treatment of the mineral with potassium sulphate at a red heat, whereby lithium sulphate is formed, which is extracted. The lithium is precipitated as the carbonate, which is converted to the chloride. The purified lithium chloride, together with potassium chloride, is then fused and electrolysed for the production of lithium metal.

The metal produced is cast into bars about 2 in. in diameter which are packed into tins, which are closed by soldering. The tins are kept for several weeks, their weights checked at intervals, and if these remain constant the metal is ready for marketing. An increase in weight, however, indicates that corrosion is taking place on account of ingress of air, with the consequent rapid transformation of the metal into the oxide and nitride. As marketed the metal is of 98 to 99 per cent. purity. The Metellgesellschaft factory at Langelsheim in the Harz Mountains is now the largest world producer of lithium and its salts.

Lithium as an Alloying Element

So far, no commercial use has been made of metallic lithium alone, but experiments conducted by P. Assman ("Zeit. Metalk.," 1926, *18*, 51-54) and others have shown it to be a promising alloying element, especially for making extra-light aluminium alloys containing small amounts of copper, lead, zinc and magnesium which are suitable for constructional purposes. The addition of up to 6 per cent. of lithium to these alloys not only increases their tensile strength and hardness, but enables them to "age" or mature so that their working properties are also improved. It has been pointed out, however, that in some cases similar results could be obtained more economically by the substitution of magnesium for lithium. When alloyed with magnesium in the proportion of 3 parts to 7, lithium produces an alloy of specific gravity 1.4 and very light alloys of these two metals have recently been produced for aeronautical purposes. Recent research in Germany has resulted in the production of a series of beryllium-lithium alloys which are stated to have industrial applications. The specific gravities of these alloys range from 1 to 1.5 and they contain from 26 to 65 per cent. of lithium.

In Germany during the latter part of the World War, lithium largely replaced tin for hardening lead in some bearing metals. It was added to lead to the extent of a few hundredths of 1 per cent., generally with small amounts of calcium, to give a bearing-metal suitable for use on railway vehicles. Thus, "bahnmetal" which has been used on the German National Railways, consists of lead with calcium, 0.73 per cent.; lithium, 0.04 per cent.; and sodium, 0.58 per cent. This alloy is stated to have a compressive strength of 25,000 to 30,000 lb. per sq. in. and a Brinell hardness of 34.

Lithium has been used to a small extent as a de-oxidising agent in the refinery of copper, and it is claimed that this is effected without appreciably reducing the electrical conductivity of the latter. The addition of lithium to copper is stated to improve its surface properties. Lithium is also reported to be useful in refining nickel and iron. Lithium chloride has been used since about 1907 as an ingredient of fluxes for welding aluminium (Brit. Pat. Nos. 24,096 and 24,283, of 1907).

Glass, Ceramic and Enamel Industries

During recent years a moderate tonnage of lepidolite and, to a less extent, of other lithium minerals including amblygonite, has been used, in the United States, in the glass industry. The mineral is added directly to the glass batch or charge in a finely-ground state and must be practically free from iron, tourmaline, quartz and other foreign matter. Lepidolite tends to reduce the viscosity of the melt, and is of value in making opal, white or flint glasses. In the case of opal glass the fluorine of the lepidolite acts both as a flux and as an opacifying agent; in the latter instance the lepidolite may amount to as much as 28 per cent. of the whole melt, the ingredients used in a typical charge being: Sand, 2,000 lb.; soda ash, 750 lb.; lime (burned), 40 lb.; felspar, 240 lb.; fluorspar, 580 lb.; lepidolite, 1,420 lb.; arsenic, 10 lb.; colour 10 oz. In the manufacture of opal glass, if lepidolite is used in place of cryolite the sides and bottom of the glass tank are not corroded.

The properties given to glass by the addition of lepidolite are stated to be a lowering of the coefficient of expansion with a consequent decreased tendency to break with sudden changes of temperature; a lessened devitrification or scumming or the melt and the production of a harder surface on the glass, with the retention of its lustre in moist air. Lithium glass, therefore, is being used for electric light bulbs. The glass produced is claimed to be tougher than ordinary glass, and so is better able to withstand shocks and vibrations whilst its refractive index, and therefore its brilliancy, is increased. Lithium glass is more permeable to X-rays than is soda glass. Glass batches containing lepidolite have been used to produce attractive glazes on terra cotta, while lepidolite, on account of its fluorine content and low fusion temperature, may find a use to reduce the viscosity of enamels. The use of lithium fluoride and sodium fluoride has been patented (U. S. Pat. No. 154,140, of 1925) for making special optical lenses which possess a low refractive index and colour dispersion.

Lithium fluoride is being employed in the ceramic and enamel industries. In the manufacture of porcelain the replacement of felspar by lepidolite gives products with a fine appearance and extreme whiteness, which possess notable resistance to thermal shocks. The high cost of lepidolite, however, limits this use except for the production of special porcelains such as are used in the sparking plugs of motor cars.

Electric Accumulator Manufacture

Lithium hydroxide, the most important commercial lithium compound, is used for prolonging the life of alkaline accumulators which consist of iron and nickel oxide electrodes with caustic potash as an electrolyte, by preventing the shrinking of the active substance of the anode. It is stated that experiments with an alkaline accumulator showed that by adding a saturated solution of lithium hydroxide to the potash electrolyte an increase of life of 12 per cent. was obtained,

although the resistance of the accumulator was increased. More recently lithium hydroxide has been added, with good results, to alkaline accumulators of the nickel cadmium type. The capacity of alkaline accumulators for withstanding rough handling and irregular charging and discharging make them specially suitable for motor cars, wireless apparatus, etc., and their use, and, consequently that of lithium hydroxide, is increasing. The hydroxide used must be of high purity and the crystalline product containing 53 to 54 per cent. of the hydroxide LiOH is preferred to the calcined variety.

The use of lithium nitride as a catalyst in the synthesis of ammonia has been patented (Brit. Pat. No. 199,027, of 1923). The compound results from the heating of lithium in an atmosphere of nitrogen.

The blackening of electric light bulbs is claimed to be prevented by a process (Brit. Pat. No. 180,334, of 1922) in which the filament is sprayed with either a fluoride, nitride, oxide or hydroxide of an element of low atomic weight such as lithium, beryllium or boron. On passing the current through the filament the compound volatilises and is deposited as a thin layer over the inside of the bulb.

Emulsifying, Wetting and Dispersing Agents

Mechanism of the Removal of Fats and Grease

In the removal of fat, grease, etc., from textile fibres the mechanism of a detergent is such that one part of the molecule dissolves in the hydrocarbon impurities, whilst another part of the molecule dissolves in water, in consequence of which the detergent acts as a linkage beween the hydrocarbon and the water, and thus enables the fatty substance to be removed. Typical detergents of this type are the sodium or potassium salts of stearic acid $CH_3(CH_2)_{16}.COOH$ or palmitic acid $CH_3(CH_2)_{14}.COOH$, the carboxyl group of which dissolves in the water whilst the hydrocarbon chain dissolves in the fatty substance. The water molecules associated with the carboxyl groups at one end of the soap molecules are then pulling at the soap molecules, and these being associated with the hydrocarbons of the fat globule are pulling in turn at the latter, with the result that the fat globule is split up and removed.

Pure oil soaps are found in practice to be more efficacious than the normal stearic and palmitic acid soaps. The pure oil soaps are unsaturated, due to the presence of a double bond in oleic acid, $CH_3(CH_2)_7.CH=CH.(CH_2)_7.COOH$. The double bond has the effect of (1) increasing the solubility in water. and (2) preventing the formation of large hydrocarbon aggregates. This can be seen in the difference in the viscosities of solutions of the same strength of stearic and oleic acid soaps. and also in the melting points of the free acids. These acids, and their calcium and magnesium salts, have the disadvantage of being insoluble in water, and consequently soaps prepared from them are precipitated in acid solution and are affected by hard water. Attempts to overcome these defects of soap resulted in the production of Turkey Red oil, the most important constituent of which is the sodium salt of ricinoleic sulphuric acid ester, $CH_3(CH_2)_5.CH(O.SO_2OH)CH_2.CH:CH.(CH_2)_7.COONa$. This sulphonated castor oil improved upon soap in that the free acid, as liberated in acid solution, was water soluble, whilst the oil itself was not so readily affected by hard water, because the calcium salts were readily soluble in water. The scouring action. wetting-out power, lathering and emulsifying properties, however, are insignificant. The sulphuric acid ester group—OSO_2OH—is in the middle of the hydrocarbon chains; it dissolves in the water and thus the hydrocarbon chain is surrounded with water and association with other fatty bodies is prevented.

Sulphonated Fatty Alcohols

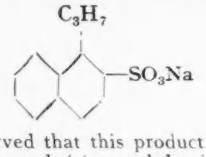
A notable advance was made by Scheurer-Kestner, who showed that several molecules of ricinoleic acid may be condensed to form various polyricinoleic acids, *e.g.*, $C_{17}H_{32}(CH)COOH + C_{17}H_{32}(OH)COOH = H_2I + C_{17}H_{32}(OH)COO.C_{17}H_{32}.COOH$. Monopol soap belongs to this class of substances, which are fairly resistant to acids and alkalis, and moderately good for wetting-out purposes. They are less fatty in character and cannot be compared with soap for scouring purposes as the hydrocarbon chains are broken up by hydroxyl groups associated with water and ester groups which have no fatty character.

H. Bertsch next indicated that the carboxyl group was responsible for the low resistance to lime and subsequent attempt aimed at eliminating this group. The Deutsche Hydrierwerke, A.G., and H. Th. Bohme prepared the sulphonated fatty alcohols. The natural fats are treated with hydrogen under a pressure of over 100 atmospheres at a temperature over 300° C. in presence of carbonate of copper or nickel. The resultant fatty alcohols are then sulphonated, the conditions depending upon the particular alcohol employed. The products are known as Brilliant Avirols, Gardinols, Sulphonated Lorol and Ocenol. The last two consist principally of the sodium salts of the sulphuric acid esters of lauryl (or odecyl) and oleyl alcohols respectively. $C_{12}H_{23}O.SO_2Na$, and $C_{18}H_{35}O.SO_2Na$. Gardinol WP is probably identical with sulphonated Ocenol. These substances have good wetting-out-powers, are adequately stable to acids, completely stable to alkalis, resistant to hard waters, and possess good emulsifying properties. They exert a light protective action on soap in the presence of lime.

Igepon A, introduced by I. G. Farbenindustrie, is obtained by condensing oleic acid with hydroxy-ethane-sulphonic acid:—$C_{17}H_{33}.COOH + HO.CH_2.CH_2.SO_3H = H_2O + C_{17}H_{33}.COO.CH_2.CH_2.SO_3H$. It has good emulsifying and wetting properties and excellent resistance to hard water, but is slowly hydrolysed by alkalis. To overcome this defect Igepon T or $C_{17}H_{33}CO.NH.CH_2.CH_2.SO_3Na$. was introduced. This product has been most successful and is the best product as yet introduced.

Neckal and Avirol

Considering wetting agents as distinct from emulsifying agents and detergents, a typical example is Neckal, which is the sodium salt of isopropyl naphthalene sulphonic acid—



It is to be observed that this product contains (1) a small hydrocarbon chain and (2) a sulphonic acid group in the adjacent position to the hydrocarbon chain; consequently, the absorbed hydrocarbon residue is not large enough to promote dissolution of any organic substance but is only sufficiently large to wet the surface. The $-SO_3Na$ group obviously dissolves in water and therefore the effect of Neckal is to enable the substance to be wetted by water, its own molecule providing the link

Another useful wetting agent is Avirol AH, the chief component of which is the sodium salt of the sulphuric ester of butyl-ricinoleic ester, $C_{17}H_{32}(O.SO_3Na).COOC_4H_9$. Humectol C now is the sodium salt of the sulphuric ester of a fatty acid amide. Both these substances are good wetting agents but have no cleansing or emulsifying properties. An interesting application of the same principle is the use of Twitchell's reagent as a catalyst for the hydrolysis of fats into fatty acids and glycerine. It is stereo-naphthalene-sulphonic acid and is prepared by treating an equimolecular mixture of naphthalene and stearic acid with H_2SO_4. The stearic acid complex dissolves in the fatty acid portion of the fats and the sulphonic acid group is left in close proximity to the ester group, which is requiring hydrolysis. This sulphonic acid group is associated with sulphuric acid and water, and consequently the latter are brought into intimate contact with the ester grouping, thus facilitating hydrolysis.

Paper from Straw by the Chlorine Process

By UMBERTO POMILIO

The following article, reprinted from the September issue of "Industrial and Engineering Chemistry," outlines the process by which straw is converted into paper at the works of Celulosa Argentina, near Rosario, in the Argentine.

OFFERING at once a profitable means of disposing of farm wastes, an important new source of cellulose, and a commercially new method of cellulose recovery, the chlorine process as applied to the purification of cellulose from wheat straw at the works of Celulosa Argentina, near Rosario, is of special importance from many points of view. Although the chlorine process is yet in its industrial infancy, experience with it during many years of development and now in industrial operation have shown it to be far superior to other methods of recovering cellulose from the stalks and stems of crop plants. Its probable development in the future may be expected to make available large quantities of cellulose from sources other than wood.

The use of gaseous chlorine in the isolation of cellulose from plants was first proposed by the English chemists Cross and Bevan, and has since become the classical method of determining cellulose in such materials. The possibility of commercialising this method was not recognised by these workers, and it was generally considered highly impractical. Despite this, numerous attempts have been made to apply it industrially and many patents applied for during the past ten years or so. Immediately after the close of the World War, Benjamin Cataldi (an Italian) and A. R. DeVains (a Frenchman) made serious efforts to perfect methods of applying the method commercially, but without success. Cataldi used gaseous chlorine, but his complicated apparatus and the high consumption of chlorine (partly due to mechanical leakage) made it impossible for him to approach the efficiency and low cost of other well-developed methods of cellulose purification. DeVains became involved in even greater difficulties than Cataldi, for he failed to realise the necessity for dissipating the heat of the chlorination reaction. He hoped to solve the problem by abandoning chlorine gas and using in its stead a water solution which he called "chlorine hydrate."

Chlorine Gas and Chlorine Water

Several plants were built to use the DeVains process, but within a decade they have all been either abandoned or changed over to another process. Many times during the period 1920 to 1924 the author stated the profound difference between the use of chlorine as a gas and in water solution. Chlorine gas serves as a chemical reagent for attacking the non-cellulose part of the material, and in this form acts only as a chlorinating agent. When, however, chlorine water is used, the reaction is one of oxidation as well as chlorination. This results in deterioration of the cellulose, changing some of it to oxycellulose, and thus reducing the yield. Industrially, the chlorine method retains its original form as suggested by Cross and Bevan—that is, a rapid preliminary leaching by dilute alkali without pressure, thorough chlorination by gas, and a final washing by cold dilute alkali. The chlorine water process, on the contrary, used strong caustic liquor, high temperature and pressure, and prolonged cooking in the digester. It was an alkali process complicated by a subsequent elaborate treatment with chlorine water and made uneconomical by the loss of the digester liquor with its considerable alkali content.

Comparison with other Processes

It is unnecessary here to describe in detail the well-known cellulose extraction processes using respectively sulphite, sulphate and soda. It is necessary only to call attention to the fact that the chlorine gas process has been considered by many to be complicated when compared with any of them, because in each the cellulose is liberated in a single treatment, while the chlorine process requires three—alkali cook, chlorination and alkaline wash. It is in this very appearance of complexity that the secret of success of the chlorine process lies, for it is absurd to assume that a single drastic treatment necessarily incomplete, could possibly free the cellulose economically from the many compounds—organic and inorganic, and acid, basic and neutral—which accompany it in vegetable fibres. It is exactly this step-by-step treatment of the chlorine process which makes possible the liberation of the cellulose in a high state of purity without destroying it and thus permits high yields approaching the theoretical.

Although the process involves three steps, each of them is accomplished without pressure, at relatively low temperatures, and with dilute reagents. The plant equipment now in use operates continuously with a minimum of attention. The laborious processes of caustic recovery and the elaboration of by-products is eliminated as uneconomical because of the small quantities of dilute solutions involved, and hence a negligible loss of reagents. The installation and operating costs of a plant using the chlorine gas process are much lower than those of a plant of similar capacity using any of the other cellulose recovery processes. Indeed, these costs are low enough to permit economical operation of plants of relatively small capacities such as might be required to utilise crop wastes. Objection has been raised to the process on the basis that the handling of so corrosive a gas as chlorine is too difficult to permit the widespread adoption of the process upon which realisation of its full economic value depends, but if we consider the enormous number of tons of chlorine and its compounds produced and used to-day in a wide variety of industries throughout the world, the fact immediately appears that this view is untenable.

Long experience, gathered in the fifteen years of development of the process, has demonstrated fully that the use of chlorine gas is superior to any other in the treatment of annual plants (cereal and other straws, stalks of cotton, corn and the textile plants, bagasse from sugar cane, esparto, and other cellulose-bearing wastes from farms). It also offers some promise of successful application in the treatment of soft non-resinous woods such as poplar and birch.

An Outline of the Working Cycle

The actual working cycle based on these principles may be summarised as follows: The vegetable fibre is treated with a weak alkaline liquor (about one per cent. sodium hydroxide) at a temperature of 80° to 90° C. at atmospheric pressure while passing continuously through digester towers in which both the speed of travel of the fibre and the temperature can be regulated. When this treatment is completed, the excess liquor is pressed out, and the fibre, after the press cakes have been torn apart, is carried by a pneumatic conveyor to the chlorinators. In the chlorination towers, the operation is continuous and the treated fibre is subjected to the action of a countercurrent stream of chlorine gas, the temperature of the mass the speed of its passage through the tower, and the concentration of the chlorine being under careful control. The chlorinated material is then carried by gravity to collecting vessels, where the chlorination, practically complete in the chlorinators, is finished and the fibre washed with water. The washed fibres then pass by gravity to the final alkali wash in apparatus resembling hollanders, provided with circulator and working drums. Here the chlorinated non-cellulose compounds are washed out of the cellulose by a weak alkaline solution at atmospheric temperature.

The plant at Rosario utilises fully the soda and chlorine produced by electrolysis from pure salt supplied from the province of Córdoba, not only for the manufacture of cellulose and paper but for other products as well. A portion of the chlorine is made into hypochlorites and hydrochloric acid; the cathodic liquor, containing unchanged sodium chloride, is evaporated to recover this in the form of fine table salt for sale. The daily capacity of the plant, in continuous operation since early in 1931, is 12 to 15 tons of cellulose, 16 to 20 tons of writing and printing paper, 2 to 4 tons of hydrochloric acid, 3 to 4 tons of sodium hypochlorite, 6 to 7 tons of refined salt, and 6 to 7 tons of concentrated, syrupy caustic soda.

Electric energy is purchased from outside sources so that the electric power plant consists merely of a group of transformers for bringing the line current at 6,500 volts down to

380 volts for plant use, and two groups of rotary converters for supplying direct current for the electrolytic cells. The electrolytic plant consists of two batteries of 28 cells each. The cells are of the vertical Giordani-Pomilio type with diaphragms and circulation, requiring 3 amp. each. Each cell produces more than 100 kg. of caustic soda and 90 kg. of chlorine per 24 hours. The brine system consists of a store room for salt of 1,000 tons capacity and a series of tanks for preparing the brine solution and purifying it from traces of calcium, settling tanks, storage tanks, and finally a feeding tank for supplying the electrolytic cells.

The cellulose department begins with a storage shed located outside the plant where baled straw is received and stored. A second shed is provided for shredding and cleaning the straw, and here the wheat grains, remaining in the straw to the extent of 1 to 3 per cent., are separated. The straw, after cutting, cleaning and shredding, is blown through pipes by a powerful fan to the chemical plant—some 200 metres. The chemical plant begins with four cylindrical digesters where the preliminary alkali cook is performed at atmospheric pressure. A crane removes the cooked material and transfers it to a system of presses where it is washed and pressed to remove the solution. Disintegrators tear apart the press cakes, and a fan blows the cooked fibre to the chlorination towers.

The Chlorinating Process

The chlorinating department consists of six towers which operate continuously on the countercurrent principle. The vegetable fibre goes in at the top and descends slowly by the action of gravity, while the chlorine gas, blown in by a fan at a convenient height, flows upward, chlorinating the mass as it descends. The speed of fall of the mass is regulated by the rate of its removal from the bottom of the tower by a mechanical arrangement operated by motors having a possible speed variation of 10 : 1. It is thus possible to treat with this system all classes of vegetable fibres, requiring mild or vigorous chlorination, to produce unfinished pulps or pure cellulose, and to use concentrated or dilute chlorine in the treatment. The treated fibre from the chlorinating towers is stored in tight chambers where chlorination is completed and every trace of chlorine is absorbed. The completely chlorinated mass is then washed with water and fed by gravity to the alkaline wash department where it is washed free from chlorinated compounds. This is accomplished in a washer where the mass is mixed for a short period with dilute cold caustic soda solution, followed by thorough washing with water. In this, as in all other operations in the chemical treatment, the water used is the waste water from the paper mill.

Paper Manufacturing Plant

The chemical treatment being now complete, the pulp is fed by gravity (after straining) to the bleaching hollanders where bleaching is accomplished by treatment with a solution of calcium hypochlorite containing 6 to 7 per cent. available chlorine. The bleached pulp is stored in tanks from which it goes to the paper mill in the form of 3 per cent. pulp. The pulp plant has a capacity of 12 to 15 tons of pulp per day. The paper manufacturing plant varies in no important particulars from the standard practice in this industry and is equipped to produce, by suitable mixing of pulps, papers of a wide variety of characteristics from rough wrapping paper, through newsprint, to fine and superfine types.

The entire process is so arranged that gravity is used throughout for the movement of materials nder treatment from one stage to the next. In his way power requirements have been minimised. The supplementary operations consist of the manufacture of sodium and calcium hypochlorites in towers cooled by refrigeration; synthesis of hydrochloric acid by burning the pure gases hydrogen and chlorine in special burners with the absorption of the product in water in a silica and stoneware system; and the concentration of alkali with the simultaneous preparation of pure salt. This last operation is carried out in a specially designed and operated system to yield a high-grade crystalline salt which is washed and centrifuged first with a neutral and then an acid wash before final drying in a vacuum drier.

The chlorine process, when properly applied either in the laboratory or industrially, produces the highest yield and the best quality of cellulose. If to this we add that the process can be so employed, using reagents which are raw and unconcentrated (salty cathodic liquor and moist chlorine gas), that it can be arranged to operate continuously, and that the recovery of waste and by-products has been completely eliminated, the economy of the process becomes obvious. The operation, too, is self-contained so that in conducting it the only necessary purchases are vegetable fibre, salt and energy or fuel.

The consumption of reagents and raw material per unit of cellulose produced depends naturally on the character of fibre and the quality of cellulose produced. Operations at Rosario show that for each 100 kg. of bleached wheat straw cellulose (12 per cent. moisture) there are consumed 15 to 16 kg. of soda for cooking, 22 to 24 kg. of chlorine for chlorination, 3 to 4 kg. of soda for the alkaline wash, and 2 to 3 kg. of active chlorine for bleaching. The cellulose yield from wheat straw at Rosario has averaged about 46 per cent. Energy consumption forms a considerable item of cost, and hence must be included in this calculation. At Rosario the energy requirement of the plant is approximately 0.8 kw.-hr. of direct current for electrolysis and 0.4 kw.-hr. of alternating current for motive power per kilogram of cellulose produced. The paper plant consumes 0.4 to 0.5 kw.-hr. per kilogram of fine paper produced.

From July 1931 to January 1932 the production of the plant had reached 314 tons of cellulose, 439 tons of fine papers, 54 tons of hydrochloric acid, 82 tons of caustic soda (for sale), and 115 tons of refined table salt (for sale). Based on these figures, the yield of cellulose has been 45 per cent. on the basis of wheat straw used.

Too Much Secrecy in Business

A Plea for More Confidence

ADDRESSING a conference of works directors, managers and foremen at University College, Oxford, on September 30, Mr. Seebohm Rowntree said that he believed the present economic depression was going to do a great deal of good to industry and that industry would emerge from this period of purging much more healthy and much stronger.

It was, however, necessary for them to learn their lessons rapidly. The first thing they must learn was that the standard required of everyone in industry was much higher than it was before adversity struck us. In every trade depression there were some alert firms in almost every industry that succeeded while the majority were doing badly; that was so to-day in the textile industry, for example, market research, leading to an exact knowledge of what foreign markets required and what prices they would pay, was absolutely essential.

In most factories success would come from having good craftsmanship supported by scientific men. In this country we had ignored men of science too much. We had won the Nobel Prizes in science and the Germans had "cashed in" on the knowledge we won. There was also too much secrecy in our business, and we lost a great deal by our unwillingness to exchange information with our competitors. It was supremely important to take workers fully into confidence. For directors to sit and deliberate in private and not to say a word to the workers afterwards was sheer folly. Why should they tell their workers less than they told their shareholders?

Netherlands Pitch Trade

THERE was a fair demand for coal-tar pitch in the Netherlands during the first six months of 1932. The large consumption of coal tar for road work limited the supply available for conversion into pitch and creosote oil. Imports of pitch increased markedly to 32,350 tons in the first half of 1932 from 24,072 tons in the corresponding period of 1931. Germany supplied practically all imports in the 1931 six-month period but during 1932, Czechoslovakia, Germany, the United States, and Great Britain were, in order of importance, chief sources of supply. Exports advanced also from 10,473 tons in the first half of 1931 to 12,173 tons in 1932.

Spirit Rectifying, Compounding and Methylating

Figures from the Census of Production, 1930

THE particulars received on schedules for the spirit rectifying, compounding and methylating trades returned under the Census of Production, 1930, cover 22 establishments at which operatives were employed, and are believed to cover all firms of importance in these trades. The quantities and values of spirits rectified, compounded and methylated in 1930 and 1924 were as follows :—

	1930		1924	
	Th. proof gal.	Value £'000	Th. proof gal.	Value £'000
Rectified or compounded spirits	1,851	5,080	1,921	5,285
Methylated spirits	10,320	597	7,024	606
Total value	...	5,677	...	5,891

The value of dutiable spirits rectified or compounded for home consumption was stated inclusive of duty, but exported spirits were valued less drawbacks. At the 1924 Census firms that employed ten or fewer persons recorded an output of 220,000 proof gal., valued at £710,000, in respect of spirits rectified or compounded, and of 177,000 proof gal., valued at £18,000, in respect of methylated spirits. The figures given for methylated spirit in the above table are also exclusive of spirit methylated by firms, under Excise control, for use in their own manufacturing processes. According to the Excise returns published in the monthly Accounts relating to Trade and Navigation of the United Kingdom, the total quantities of spirit received free of duty for methylation in the calendar year 1930, was about 10,709,300 proof gal., and, in the calendar year 1924, about 7,362,600 proof gal.

Exports of home-made methylated spirits in 1930 were about 64,000 proof gallons, and in 1924 about 49,000 proof gallons; imports were not separately recorded. The total value of other products made for sale by firms in these trades in 1930 were recorded as £115,000, of which £100,000 (325,000 gal.) represented British-made wine; the corresponding total for 1924 was £76,000, of which £34,000 (123,000 gal.) related to British-made wine.

The following figures show the total cost of materials used by firms that made returns on schedules for the Spirit Rectifying, Compounding, etc., Trades, together with their net output :—

	1930	1924
	£	£
Cost of materials used	4,850,000	4,898,000
Net output	674,000	944,000
Net output per person employed ...	931	1,140

A total quantity of 305 thousand kilowatt-hours of purchased electricity was returned as used in 1930 for all purposes at the factories to which this report relates. At the Census of 1924 information as to the quantity of electricity used was not required compulsory, but firms owning 42.4 per cent. of the total capacity of the electric motors (in use) driven by purchased electricity stated voluntarily that 111,000 kilowatt-hours were purchased by them in that year.

Singeing and Dyeing Cotton Piece Goods

An Unsuspected Connection between Faulty Singeing and Uneven Dyeing

IT is well-known that under the combined influence of heat and air (oxygen) cotton may be readily degraded with oxycellulose formation such that it loses part of its normal affinity for direct dyes. Some three years ago G. E. Holden ("J. Soc. Dyers and Co.," 1929, *45*, 205) drew particular attention to oxycellulose formation in the singeing of cotton piece goods—a process in which the fabric is led in open width over a red-hot copper plate or a row of gas flames for the purpose of removing the loose projecting fibre ends which give the fabric surface an undesirable hairy appearance. It was shown that measurable amounts of oxycellulose could be traced to uneven formation of this oxycellulose over the surface of the fabric. Holden has now returned to this subject and shown that faulty dyeing may result indirectly from singeing even when this process is uniformly carried out. These new facts are of considerable interest to bleachers and dyers of cotton fabrics.

Effect of Singeing

When a cotton fabric is singed it is believed that its surface becomes coated with a superficial layer of oxycellulose; under satisfactory conditions of singeing this layer will be quite small and probably have only a slight influence on subsequent dyeing if the singeing is uniform. This oxycellulose will be present only on the outer fibres which constitute the yarns present. But if the fabric be now treated so that under the influence of excessive friction by rubbing, or otherwise, the fibres in the yarns are disturbed then the oxycellulose may be removed or covered patchily throughout the fabric. Then, on subsequent dyeing, some parts of the fabric will show a greater affinity than others for direct dyes; unsatisfactory dyeings will thus be the result. It would thus appear necessary for bleachers to take especial care as regards the mechanical manipulation of fabric after singeing.

In practice, singeing is usually followed by washing, kiering and bleaching, the fabric being in rope form during the whole of these processes. Whilst travelling from one machine to another the fabric is led through numerous guiding pot-eyes and it is here that sufficient friction may arise to give uneven oxycellulose distribution on the surface of the fabric. Similarly, the upward and downward motion of the fabric within the kier (the so-called "breathing") may cause rubbing, especially of those parts of the fabric adjacent to the kier wall and thereby lead to disturbance of the oxycellulose. For much the same reason unnecessary friction or skidding of the fabric during passage through the necessary squeezing mangles should be avoided.

Oxycellulose Stains

Oxycellulose stains as seen after dyeing are often difficult to trace but with the above facts in mind this task should be appreciably easier. It is quite likely that friction on fabric after singeing may in many cases be the cause of uneven dyeing faults which have in the past proved impossible to trace. Of course, when fabric actually does contain oxycellulose stains it is necessary to correct these. Mercerising or boiling with caustic soda of about 4 per cent. is helpful, since it dissolves the oxycellulose, and in this connection useful references may be made to the investigations of E. Knecht ("J. Soc. Dyers and Col.," 1921, *37*, 271) These treatments, however, are not always sufficient to make the fabric perfectly even-dyeing. Holden suggests that the Janus dyes can be used under these circumstances since they have both direct and basic dyeing properties, and as is well known oxycellulose is characterised by a decreased affinity for direct and an increased affinity for basic dyes. For mode or drab shades it is found that the older natural wood dyes have about equal affinity for normal cellulose and oxycellulose. It may also be pointed out that oxycellulose stains become obscured when the fabric is mordanted with tartar emetic and tannic acid and then dyed with basic dyes.

Oxycellulose stains as produced by singeing and subsequent friction can result from both gas and plate singeing, but as might be expected they are the more likely to arise in plate singeing where the fabric is drawn over a hot copper plate which may not have a perfectly level surface.

New Knowledge on Refractory Materials

Papers read before the Refractory Materials Section of the Ceramic Society

IMPORTANT contributions to our present knowledge of refractory materials were included among the papers read at the 26th meeting of the Refractory Materials Section of the Ceramic Society which was held in London, September 20-21.

The opening paper by H. W. Hibbott and W. J. Rees on "The Influence of Cyanogen on the Reduction of Carbon Monoxide in Contact with Refractory Materials," was noteworthy for having a bearing on industrial practice in view of the fact that cyanogen is known to be present in blastfurnace gases and liable to occur in other cases where coal is used as fuel for high-temperature operations. The authors reported experiments in which carbon monoxide mixed with different proportions of cyanogen was passed over a weighed quantity of firebrick fragments at varying temperatures. From the results obtained it is evident that cyanogen has a marked effect on the reduction of carbon monoxide passing over fractory surfaces. With only 0.2 per cent. of cyanogen the reaction is increased—as compared with what happens when carbon monoxide alone is used—and the reducing effect is still greater with 0.5 per cent. of cyanogen. With 1.5 per cent. cyanogen the effect is slightly less than with 0.5 per cent., though much greater than for carbon monoxide alone—the temperature range in all the foregoing cases being 370° to 500° C. With 45 per cent cyanogen the main reaction does not start below 540° C. and the amount of reduction is much less than for carbon monoxide alone. With 10.2 per cent. and 23.0 per cent. cyanogen the reaction is so slight as to be practically negligible.

Heat-Resisting Metals in Furnace Practice

The next paper, by I. J. Sarjant, dealt with "Some Factors Affecting Furnace Practice." In the course of this paper the author pointed out that applications of heat-resisting metals are ranged in three classes. Firstly there are the alloy steels, used up to 600° C., which contain various amounts of chromium with small proportions of nickel and molybdenum. These alloys were developed primarily for use with superheated steam plant, and their special properties are increased resistance to creep, and absence of any embrittlement occurring with lapse of time under service conditions, for example, in bolts and superheater tubes. In the second class there are alloy steels, used up to 950° C., for general furnace uses, containing 18 to 25 per cent. of chromium and 7 to 12 per cent. of nickel, with some silicon and tungsten. Thirdly, materials used up to 1,100° C., including either high chromium irons containing 0.5 to 2 per cent. of carbon and 25 to 30 per cent. of chromium, or high-nickel chromium, or high nickel chromium steels containing 15 to 30 per cent. of chromium, and 12 to 80 per cent. of nickel offer greater resistance to oxidation and are better for repeated heatings. Strength at high temperatures is a dominant property of all these alloys, which can be produced as castings, forgings (both of which are machineable), rolled bar and sections, sheet, wire and drawn tubes.

Open-Hearth Furnaces

A contribution by R. Percival Smith concerning "Sidelights on Refractories in Open-Hearth Practice," consisted largely of an account of investigations carried out at the works of Steel, Peach and Tozer, Ltd., with the aim of discovering in what directions it might be possible to effect economies in connection with refractories. This was attempted by ascertaining first the proportion of the costs that was due to bricks and bricklaying. It was found, for example, in connection with the cost of ingots, that the cost of bricks and bricklaying was 17 per cent. of the total melting cost and 22 per cent. of that part over which the management and workers of the melting shop were able to control directly. In one open-hearth furnace it was found that the air ends showed a surprising proportion of loss, which suggested a possible means of economising. The use of ganister for patching ladles between heats seemed economical, but when the work was carried out without such patching and figures got out, it was found that the cost per cast with ganister patching was substanially greater, in spite of the much shorter life of the ladle.

A joint paper by Dr. J. H. Chesters and Dr. W. Weyl on "The Drying of Magnesite Bricks" dealt with volume changes which accompany hydration. The total expansion after drying and cooling was found to be greatly influenced by variations in draught (and hence of drying time). The most rapid expansion occurs when a wet test piece is maintained in the temperature region 85° to 100° C. Above 100° C. the water concentration (except in an autoclave) falls off very rapidly, and in practice very little further expansion is likely to occur. The determination of the increase in hydrate in specimens dried under controlled conditions showed that a qualitative relation exists between hydration and linear expansion, but that until the hydration-expansion is sufficient to compensate the drying shrinkage, no resultant expansion occurs. The drying of test pieces *in vacuo* showed the possibility of lowering the drying time without passing the temperature, and hence the hydrate formation. The possibility of applying vacuum drying was therefore suggested for large shapes.

The influence of the characteristics and treatment of the raw material on the properties of fused silica products, and the effect of treatment of the fused products on their properties was discussed by Dr. Burrows Moore, who pointed out that volatile impurities are largely responsible for blisters and pinholes in products, and although never forming more than 0.1 per cent. in passed raw material, a change of less than 20 per cent. in the amount present may produce differences in the products.

Refractory Materials under Torsion

Among the remaining papers was one by Dr. A. L. Roberts and Professor J. W. Cobb on "The Behaviour of Refractory Materials under Torsion at Different Temperatures," with a description of apparatus in which the behaviour of refractory materials under torsional stress has been investigated at temperatures up to 1,050° C. The observations made suggest that the development of an increased resistance to shearing stresses, as the temperature is raised, is characteristic only of the materials examined which contain free silica in the crystalline condition, and that the magnitude of the change depends on the amount of crystalline silica present. It also appears that the decrease in resistance to torsional stress, which commences, in all cases except that of silica glass, at temperatures within the range 800° to 950°, corresponds to the beginning of softening of the materials. Vitreosil and transparent silica glass undergo a similar decrease in torsional strength at 980° to 1,020° C. and at approximately 1,100° C. respectively. It is considered possible that the decrease in torsional strength at 800° to 950° C. may be due to a change in the properties of a siliceous glassy matrix.

The last paper, by A. Edwards and P. F. Clephane, was on "The Evaluation of Cellulose Sulphite Lye," the use of cellulose sulphite lye in the preparation of silica cement and silica bricks and shapes having created a necessity for methods of evaluation and analysis. This paper described methods devised in the laboratory of The Gas Light and Coke Co., at Beckton.

French Synthetic Nitrate Production

FRENCH Government nitrogen production during 1931, at the plant located in Toulouse, totalled 59,570 metric tons of ammonium sulphate and 4,396 tons of mixed salts including nitrates. The funds allocated to date by the French Treasury to this plant amount to 465 million francs. Granulated "ammonnitre" production was inaugurated December, 1931, and the total French sales of this product during the spring season reached 12,000 tons. It is planned to increase the output of the salt. Toulouse is operated by l-Office National Industrial de l'Azote.

Rezyls and Teglacs for Surface Coatings

A Range of Modified Glycerol Phthalate Resins

This article is based on notes supplied by Cyanamide Products, Ltd., the English representatives of the American Cyanamide Co.

PROGRESS in surface coatings during recent years has been very rapid. Varnishes have changed from the linseed oil fossil gum type to those made from wood oil and various rosin compounds. Nitro-cellulose lacquers have had a tremendous development in spite of failures in some fields to which they were not basically well adapted. Cellulose acetate lacquers seem to have some very definite possibilities, but how far they will supplant other finishes no one can now predict. And now linseed oil, the standby of the paint industry, appears on the verge of being displaced (for some uses) by more durable vehicles.

Astounding Characteristics

Outstanding among the newer types of raw materials for surface coatings are the modified glycerol phthalate resins known as Rezyls and Teglacs. While for the sake of convenience they are grouped as "phthalate resins," the actual ingredients include a wide range of polybasic acids, polyhydric alcohols, and modifying agents, combined under different conditions to produce a tremendous variety of resins suited for use in such widely different finishes as nitro-cellulose lacquers, cellulose acetate lacquers, paint and varnish products, so-called synthetic finishes, textile and paper coatings, water solutions, printing inks, and others. These Rezyls and Teglacs range from viscous liquids to hard brittle solids and, in colour, from deep amber to almost water white. These are not mere differences in quality, produced by the use of more or less carefully refined raw materials, or by dilution with ester gum or other cheap materials. They are distinctly different compounds designed for specific uses. In spite of their differences, however, the Rezyls have certain qualities in common, the most outstanding being their retention of toughness with age coupled with opacity to ultra-violet light and a remarkable durability on weather exposure. Most of their important uses are based on these qualities.

For a clear understanding of the possibilities of formulating with the Rezyls and Teglacs they are classified, according to their composition and suitability for various uses, into four groups, the members of each of which have certain similar characteristics. These groups are as follows:—(1) Lacquer types, or saturated Rezyls. (This group may be further subdivided into resins compatible with nitro-cellulose and those designed primarily for use with cellulose acetate. (2) Teglacs or glycerol phthalate resins modified principally with natural resin acids. (3) Oxidising types or unsaturated Rezyls, which have uses similar to those of oleo-resinous varnishes and drying oils. (4) Rezyls for miscellaneous applications.

Durability in Ultra-Violet Light

It is well known that the ultra-violet rays of sunlight cause rapid deterioration of ordinary lacquers and that their resistance is reduced by the increased use of the natural and manufactured resins heretofore available. Rezyls, on the contrary, when incorporated with nitro-cellulose in either clear or pigmented lacquers have the property of greatly increasing the life of such coatings by reducing this surface disintegration. This has been demonstrated by frequent and severe weather exposure tests under different climatic conditions as well as by accelerated tests under the mercury vapour lamp. Rezyl lacquers not only stand up better than other lacquers under these conditions but better than many other finishes including high grade spar varnish. The Rezyl content of nitro-cellulose lacquers for outdoor use should therefore be increased as far as working and drying qualities will permit. This exceptional durability is undoubtedly associated with the fact that the Rezyls themselves are relatively opaque to the short light waves and not readily altered by them.

The Rezyls introduced for use in nitro-cellulose lacquers are miscible with nitro-cellulose in all proportions, compatible with the other resins ordinarily used in lacquer, and completely soluble in the usal solvents. They may therefore be worked in with almost any combination of other materials without danger of blushing or other difficulties. Since the Rezyls impart durability rather than the brittleness associated with other resins it is possible by their use to decrease the proportion of nitro-cellulose and increase the percentage of total solids at a given consistency. Due to the fact that Rezyl lacquers usually contain a preponderance of Rezyl over nitro-cellulose, the viscosity characteristics of the nitro-cellulose are of less importance than in ordinary nitro-cellulose lacquers. Consequently, the use of nitro-cellulose of viscosity higher than the half second type is usually possible. Moreover, since the Rezyls are soluble in practically all the ordinary combinations of solvents suitable for nitro-cellulose, no change from regular formulation is required.

The ordinary plasticisers such as dibutyl phthalate, tricresyl, phosphate, or blown castor oil give satisfactory results in Rezyl lacquers, but since the Rezyls, especially the soften types, are more flexible than other resins they require the use of a slightly smaller proportion of plasticiser. The Rezyls dissolved in medium or high boiling solvents may be used either alone or mixed with plasticisers as the vehicle for grinding pigments on stone, roller, or pebble mills. Highly basic pigments such as zinc oxide, carbonate white lead, whiting and aluminium hydrate should not be used with Rezyl lacquers but most of the ordinary colours can be used satisfactorily. Titanium oxide or zinc sulphide are used for white and light tints.

Economical Formulation

The replacement by Rezyls of part of the nitro-cellulose in a lacquer results not only in improved durability but also in some saving in cost. Rezyls, however, cannot economically be used to replace equal quantities of cheap non-durable gums. Rezyl lacquers may be formulated in a variety of proportions to secure a wide range of characteristics. The viscosity of any of these lacquers will of course depend not only on the solvent which is present but also on the grade of nitro-cellulose which is used. When durability to the weather is the primary requisite the proportion of Rezyl to cotton should be as high as permitted by the necessary hardness of film. A typical clear finishing lacquer for outdoor use may consist of dry nitro-cellulose 100 lb., Rezyl 250 lb., and dibutyl phthalate 60 lb. Still higher proportions of gum to cotton are possible with the oxidising type Rezyls. High proportons of Rezyl not only give durability but also adhesion, gloss and fullness.

Until recently most automobile body lacquers have been formulated with low viscosity nitro-cellulose, plasticiser, and a comparatively small proportion of resin. While the Rezyls may be used to replace other resins in this type of lacquer, their real advantages are secured by their use in higher proportions. Under ordinary conditions of application, the proportions suggested are:—Dry nitro-cellulose 100 lb., Rezyl 70 to 100 lb., blown castor oil 20 to 30 lb., dibutyl phthalate 20 to 30 lb., and pigment (depending on colour) 10 to 100 lb. Some of the newer types of lacquer, applicable not only to autos but also to metal furniture and other articles, involve the use of substantially higher proportions of Rezyl than those just described. Methods of application which are altered to fit the working properties of these finishes, usually include force-drying at elevated temperature. These new finishes offer a number of definite advantages. They may be made from 5 sec. cotton if desired instead of the usual ½ sec. grade and still have higher solid content at spraying consistency than ordinary lacquers. Finishing may be completed at lower costs because of savings in both labour and material. They impart higher gloss and greater depth of finish and sometimes permit the use of fewer coats. They also have better durability which is evidenced especially by prolonged retention of gloss and colour. These lacquers are intended for spray application of several coats over the customary primer and surfacer. The finish is then force dried until just hard enough to be sanded free from specks and orange peel. A final baking operation flows out the sandpaper scratches and develops a smooth, hard, glossy surface with partial or complete elimination of the usual mist-coating and polishing operations.

In view of the scarcity of resins compatible with cellulose acetate, the Rezyls which have been introduced for cellulose acetate lacquers are of special interest. Several types are available of various degrees of hardness and compatibility with cellulose acetate. They impart gloss and adhesion and do not detract from the slow burning qualities of cellulose acetate films. These Rezyls are freely soluble in the usual cellulose acetate solvents such as ethyl lactate, acetone, di-acetone alcohol, and ethyl methyl ketone, as well as in cellosolve and equal parts denatured alcohol and toluol. They are not soluble in coal tar or petroleum hydrocarbons. Ethyl Lactate is one of the few good high boiling solvents for cellulose acetate. Its unusual tolerance for dilution with coal tar hydrocarbons is as follows:—Acetone 0.90, ethyl acetate 0.25, ethyl methyl ketone 0.20, di-acetone alcohol 0.95, ethyl lactate 2.40. These figures show parts of benzol added to one part of a 10 per cent. solution of cellulose acetate, in each of the solvents indicated, before precipitation occurred.

Applications for Teglacs

The Teglacs are glycerol phthalate resins modified with natural resin acids. They have a wide field of application in the replacement of other resins in various types of indoor finishes, although they lack the toughness and extreme durability on weather exposure of the Rezyls. Their outstanding characteristics are hardness and a high refractive index which imparts exceptional gloss and depth to clear finishes formulated from them. These resins impart excellent gloss, adhesion and hardness and are therefore especially well adapted for use in clear and pigmented wood lacquers, sanding sealers, and other types not subjected to severe outdoor exposure. As they are more compatible with nitro-cellulose, plasticisers and most solvents than many of the other resins ordinarily used, gum blushing troubles are eliminated. They are easily soluble by agitating with cold toluol and require no de-waxing or other special treatment. On account of their ready solubility in blends of cellosolve and petroleum distillates or turpentine they are well suited to the production of gloss brushing lacquers of mild odour. Their colour is comparatively pale with little tendency toward after yellowing.

Oxidising Rezyls

The oxidising Rezyls are unsaturated phthalate resins, which are distinguished from the lacquer types in that when exposed to the air in thin layers they dry to hard solid films. They differ from other types of manufactured and natural resins in that they combine in themselves the qualities of gloss and hardness usually associated with resins together with the elasticity and toughness of drying oils. They may therefore be used as durable film forming agents without cooking with oils. They find also some application with nitro-cellulose for the production of lacquers with excellent hardness, toughness and adhesion.

Such Rezyls cover a wide range of hardness, flexibility and other characteristics which opens to them possibilities for use in practically the whole field of paint products from quick drying varnishes and enamels to house paints and other outdoor finishes. Their most notable quality is their exceptional durability on exposure to the weather. They have, in addition, excellent adhesion and retention of elasticity with age. They do not discolour readily on baking or on exposure to light and are therefore especially well suited for use in white and light tints.

Choice of Solvents

Petroleum hydrocarbons such as naphtha, mineral spirits, and kerosene are relatively weak solvents for the Rezyls. The proportions in which they can be used depend on concentration of the solution and exact type of solvents present. Coal tar hydrocarbons such as benzol, toluol, xylol, and solvent naphtha are excellent solvents for all the oxidising Rezyls. The low boiling fractions are stronger solvents than the slow evaporating types and therefore yield solutions of lower and more uniform viscosities. Di-pentene, turpentine ethylene dichloride and carbon tetrachloride are solvents for most of the oxidising Rezyls although weaker than coal tar naphtha. Pine oil and alcohols are often included in small amounts with solvent mixtures to insure good flow and reduce viscosity of Rezyl solutions. The solvent strength of pine oil is about equivalent to xylol. Ethyl lactate is an excellent solvent, permitting more dilution with petroleum thinners than is feasible with coal tar naphtha. Acetone, ethyl acetate, butyl acetate and most of the other usual nitro-cellulose solvents are also good solvents for the Rezyls.

The oxidising Rezyls are distinctly different from other natural and manufactured resins in that their primary value in surface coatings does not depend on their being cooked into oleo-resinous varnishes. They combine elasticity, toughness and hardness and are therefore similar in many respects to complete varnish bases. They may however be modified for certain purposes by cooking with drying oils and other resins. With tung oil alone it is difficult to secure gas-proofness. Better results are obtained with the addition of some linseed oil, rosin, ester gum, or phenol resins. The products obtained by the addition of oils have great flexibility and are very durable when exposed to the weather although they are rather soft for general use as indoor varnishes. Aluminium kettles should be used when cooking Rezyls, avoiding copper, monel or iron which will result in cloudy and dark coloured products. No limed rosin should be used and metallic driers should be added in liquid form after the varnish has been thinned and cooled.

Emulsification Problems

Mixed Liquids of High Molecular Weight

THE emulsification of mixed liquids of high molecular weight was the subject of a useful paper contributed to the recent textile and colloid discussion at Manchester, the authors being J. B. Speakman and N. H. Chamberlain, of the Textile Chemistry Laboratory, Leeds University. In order to facilitate manipulation of the fibres, oil is applied to wool prior to carding and combing, and its subsequent removal, by means of soap and soda solution, presents an interesting problem in the theory of emulsification and detergent action. As regards the woollen trade, the oils employed consist mainly or entirely of oleic acid, and their removal is brought about simply by saponification with soda. Chief interest is therefore associated with the worsted trade, where oils containing not more than 5 per cent. of free fatty acids are customary. The amount normally used in combing is 3 per cent. by weight, and if this is assumed to be normally distributed over wool having an average fibre diameter of 20 μ (64's quality), the thickness of the oil film is of the order of 0.2 μ.

Use of Olive Oil

Hitherto it seems to have been assumed that the ease of emulsification of oils by means of soap solution is governed simply by the magnitude of the interfacial tension and the formation of a stable adsorbed film at the interface, but it now seems probable that, whether the oil is distributed as a thin film on a solid surface or is present in bulk, emulsification will be opposed by molecular adhesion in one or other of its various manifestations. The experiments recorded in this paper were therefore designed to discover the importance of such adhesion phenomena, and are essentially industrial in their purpose and method. In addition, they have a specific interest for the worsted section of the wool textile trade. As already indicated, the oil applied in combing is distributed as a thin film which exposes an enormous surface to the atmosphere. The risk of oxidation is therefore high, and oxidised oil resists emulsification with soap to such an extent that none but non-drying oils can be used as wool lubricants. Of these available, olive oil has found general favour and, in this country at least, is employed to the exclusion of other types.

At first sight it would be expected that mineral oil, being completely free from oxidation risk, and less expensive than olive oil, would succeed in displacing the latter. Actually, mineral oil is never used as a wool lubricant because it is impossible to remove it by emulsification with soap and soda solution. The reason for this peculiarity has never been established, and an endeavour has been made to discover the part played by adhesion phenomena in emulsification, and to establish the reason for the difficulty experienced in removing mineral oil from wool.

Society of Chemical Industry

Opening Meeting of the London Section

THE opening meeting of the session of the London Section of the Society of Chemical Industry was held at Burlington House, London, on October 3, and took the form of a joint meeting with the Chemical Engineering Group. Dr. Monier-Williams, chairman of the London Section, presided and was supported by Mr. J. Arthur Reavell, chairman of the Chemical Engineering Group.

The occasion was the delivery of the Jubilee Memorial Lecture by Dr. G. D. Bengough on "The Corrosion of Metals in Salt Solutions and Sea Water." This lecture is being delivered in four sections, each being a continuation of the previous one. At the meeting on Monday, Dr. Bengough discussed the measurement of corrosion and will subsequently deal with other sections of the problem before the Glasgow, Manchester and Newcastle sections. The work which is being described in these lectures is being carried out at the Chemical Research Laboratory at Teddington, under the charge of Professor G. T. Morgan. It is recognised that it will occupy several years but that already results have been obtained which will fully justify the expenditure of the money which has been allocated to it by the Department of Scientific and Industrial Research. It has also been made manifest that the experience already gained from the investigations in high pressure research at the Chemical Research Laboratory at Teddington is aiding this corrosion research.

Controlled Laboratory Experiments

Dr. Bengough in the first portion of his lecture put the case for controlled laboratory experiments as a preliminary to industrial and field tests, and in the first place, he is concentrating upon steel in this connection. The object is to obtain corrosion-time curves and to ascertain the factors which control the corrosion rate. In this way it is believed that results of greater significance will be obtained which can be correlated with any industrial conditions that may be specified. He put forward the view that the great variability between the results hitherto obtained by various investigators is due to the absence of control of experimental conditions. Therefore, the first object of the work in hand is to obtain long and continued corrosion-time curves of known reproducibility, specially studied for the elucidation of the controlling factors.

The external factors which may affect corrosion experiments in salt solutions were stated as follows:—(1) Method of preparing the surface; (2) method of suspension of specimen; (3) sizes and shape of specimen; (4) the depth of immersion; (5) cross section of vessel; (6) volume of corroding liquid; (7) stability of apparatus; (8) temperature, particularly fluctuation, and (9) pressure, particularly fluctuations of the oxygen partial pressure.

Each of these factors was discussed in some detail, and emphasis was laid upon the fact which has emerged from the work so far, that hydrogen evolution plays a considerably greater part in the corrosion process than has often been suspected. The form of apparatus used in the experiments and the method of suspending the specimen was illustrated, discs of metal 0.4 c.m. thick having been decided upon as the standard specimen, to be held in a horizontal position, the surface being turned.

Dyestuff Licences

Applications in September

THE following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during September has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee. The total number of applications received during the month was 389, of which 340 were from merchants or importers. To these should be added three cases outstanding on August 31, making a total for the month of 392. These were dealt with as follows:—Granted—379 (of which 372 were dealt with within seven days of receipt); referred to British makers of similar products—10 (all of which were dealt with within seven days of receipt); outstanding on September 30—three. Of the total of 392 applications received, 382, or 97 per cent., were dealt with within seven days of receipt.

New Technical Books

AN INTRODUCTION TO ORGANIC CHEMISTRY. By Ira D. Garard. Pp. 296. Chapman and Hall, Ltd. 16s. 6d. net.

When writing this book the author had in mind the needs of those who take an "introductory course" in organic chemistry. Such courses so frequently constitute the student's only general training in organic chemistry, and emphasis has therefore been laid on the more fundamental reactions and on groups of compounds which are really important. An effort has also been made to overcome the difficulties commonly associated with chemical expressions, a large amount of descriptive matter being included to make the subject appear more real. It is hoped that the book will be found useful to introduce prospective chemists to the field of organic chemistry, as well as to offer a concise course to students of agriculture, biology, pharmacy, etc.

* * *

TRANSACTIONS OF THE INSTITUTION OF CHEMICAL ENGINEERS. Vol. 9 (1931).

The ninth volume of these Transactions, like its predecessors, continues to add to the wealth of chemical engineering data collected by authors in their respective papers read before the Institution. Prominent among the contents of this issue is the discussion on "The Education and Training of the Chemical Engineer," which took place at the annual meeting of the Institution, when the subject was introduced by Mr. J. Arthur Reavell. The papers include "Flax Wax and its Extraction," by W. H. Gibson; "The Recovery of Gum from Fossil Kauri Timber," by R. G. Israel; "Extraction of Terpene Chemicals from Waste Pipe Wood," by I. W. Humphrey; "Leucite as a source of Alumina, Potash and Silica," by Baron G. A. Blanc; "The Flow of Gases at High Pressures through Metal Pipes," by D. M. Newitt and S. K. Sirkar; "The Concentration of Phosphoric Acid by Submerged Combustion," by C. Featherstone Hammond; "Oils for Wool, Rayon, Silk and Cotton," by W. F. Vickers; "The Gas Generator as a Direct Producer of Metallurgical Products," by N. E. Rambush and F. F. Rixon; "Coal-Smokeless Fuel and Oil from the National Standpoint," by W. R. Ormandy; "Hydrogenation," by E. F. Armstrong; and "The Manufacture of Asphalt from Cracking Process Residues," by F. M. H. Taylor. There is also a notable paper on "High Temperature Heat Insulation," by M. L. Nathan, which was read before the graduate and students section of the Institution, being awarded the Junior Moulton Medal, 1931.

Voluntary Liquidation

Cellulose and Allied Products (Hounslow) Ltd.

THE creditors of Cellulose and Allied Products (Hounslow), Ltd., Green Lane, Hounslow Heath, Middlesex, cellulose and chemical manufacturers, were called together on October 5 at Southern House, Cannon Street, E.C. It was reported that the total liabilities were £2,605, which included £900 in respect of debentures, £605 to trade creditors, a bank overdraft of £322 and loans by directors £1,677. The assets, which amounted to £254, were insufficient to meet the claims of the debenture holders and there were consequently no assets available for distribution amongst the unsecured creditors.

Mr. H. JACKSON, a director of the company, said that for eighteen months past the directors had endeavoured to keep the business alive by putting in monies but it was eventually found impossible to continue trading and the company had to go into liquidation, a receiver being appointed on behalf of the debenture holders. Difficulties arose through severe trade depression and the company had suffered also through keen competition. The company had a high reputation in the trade, but the turnover had been insufficient to cope with the overhead expenses. The directors had made considerable financial sacrifices in the hope that the company might be able to pay its way.

Resolutions were passed in favour of the appointment of Mr. T. Chard, of 3 Central Buildings, London, S.W.1, as liquidator of the company.

News from the Allied Industries

Non-Ferrous Metals

THE COPPERSMITH TINPLATE WORKS at Cwmavon, Port Talbot, restarted work with four mills this week, after a prolonged period of idleness. About 140 men are being restarted. The Mond nickel works at Clydach, Swansea, are also to restart, and by November approximately 350 men will be back at work—about half the usual complement. The works ceased operations a month ago to work off an accumulation of stocks and to install more modern machinery.

Mineral Oil

A BILL HAS BEEN INTRODUCED in the Cuban Senate to grant exclusive rights for forty years for the sale of petroleum in Cuba to an oil company which, though not named in the Bill, is understood to be the West India Oil Co., a subsidiary of Standard Oil of New Jersey. At present Cuba has several companies selling petroleum, including British interests. If the Bill is passed, British oil will be excluded from Cuba. Under the terms of the Bill the favoured company would be required immediately to repay the entire Cuban debt, including internal obligations for public works, external debts for foreign loans, and the floating debt, amounting together to $200,000,000. The measure also provides that oil companies now operating in Cuba would sell their plants by auction.

Beet Sugar

THE BARDNEY FACTORY of the Lincolnshire Sugar Co. has opened to receive the first consignments of sugar beet from farmers, and both the Bardney and Brigg factories will soon be working night and day. The third Lincolnshire factory at Spalding is also commencing operations this week. The crop is now a very important one in the county, and in spite of the difficulties which both the farmers and the factories have had to face, sugar beet has steadily gained in popularity. This year, for instance, the Bardney factory has 2,800 growers compared with 2,500 a year ago, and growers for the Brigg factory have also increased proportionately. Lincolnshire is probably the only county where there are two contract prices in operation. Bardney and Spalding are paying 40s. per ton for beet this year, while Brigg, like the Yorkshire factory, is paying 42s. Owing to its favourable position for water transport, many Trentside and South Yorkshire growers have this year made contracts with the Brigg factory. Both the yield and sugar content are expected to compare favourably with those of last year.

Artificial Silk

UNITED KINGDOM OUTPUT OF RAYON YARN and waste in August was 4.62 million pounds, as compared with 5.71 million pounds in July, and 3.66 million pounds in August, 1931. As percentages of 1924 figures, these figures are 219,271, and 174 respectively.

ATTENTION IS DRAWN in the course of a survey of the rayon industry by an anonymous writer in "Metallbörse," September 28, 1932, to the immensely powerful position still occupied by the viscose branch. Accounting as it did for nearly 89 per cent. of the world's output of synthetic yarn in 1931, viscose would indeed appear to be securely entrenched as the dominating factor in the international rayon market. As the corresponding figure for 1929 was 82 per cent., its nearest rival—cellulose acetate—can hardly be said to be within measurable distance of ousting it from the top place. Only 7.2 per cent. of the world's output of artificial textiles in 1931 was represented by cellulose acetate, the trifling balance being accounted for by cuprammonium (Bemberg) and nitro silk. Although in the textile industry cellulose acetate is not altogether fulfilling the hopes which were formerly reposed in it, the figures quoted need not be interpreted too pessimistically. Less than a decade has elapsed since the spinning and dyeing of acetate yarn were placed on anything approaching a satisfactory basis, and the intervening years have witnessed a steady increase in production in the face of the well-developed technical and marketing organisation of the viscose group, which could look back on twenty years of triumphal progress. Outside the immediate field of textile, too, cellulose acetate has made undoubted progress, particularly in the safety-glass, non-inflammable film, transparent paper, and plastic moulding industries.

Iron and Steel

PROSPECTS FOR THE RECONSTITUTION of the International Steel Cartel have improved as a result of the report that the negotiations which have been taking place between the Belgian steel producers are developing on favourable lines. It is stated that the main reason for this favourable development is the intervention of certain important Belgian banks which are anxious to see the attainment of international co-operation in the steel industry. It is understood that pressure has been brought to bear on the recalcitrant Belgian works and that it has been pointed out that any further deterioration in the position would have unfortunate consequences for these works themselves. The Luxemburg steel producers are also stated to be more optimistic regarding the possibility of reconstituting the international steel cartel.

THE POSSIBILITY OF ANOTHER STEEL MERGER is being discussed on Tees-side, the firms concerned being Dorman Long and Co., the Cargo Fleet Iron Co. and the South Durham Steel and Iron Co., known as the Furness group. The capital involved is £18,000,000.

China Clay

NEGOTIATIONS HAVE BEEN PROCEEDING for some time past for the fusion of three of the leading companies in the china clay trade, namely, Lovering China Clays, English China Clays, and H. D. Pochin and Co., the object of this fusion being to avoid competition and effect substantial economies. The draft agreement provides for the formation of a new company, to be called English Clays, Lovering, Pochin and Co., Ltd., amalgamation taking effect as from September 30 last. The new company is to acquire from the vendor companies the lease of the clay lands at present owned or occupied, or, where a freehold interest is owned, a direct lease for thirty-five years. It will also acquire such other assets of the vendor companies and their subsidiary and allied companies as relate to the production and selling of china clay and its kindred products. The assets to be acquired are to be valued by Mr. Eve, of Gerald Eve and Co., of London, and the consideration payable to each vendor company will be the valuation figure fixed by him. The consideration will be satisfied by the allotment of fully-paid preference and ordinary shares of £1 each in the capital of the new company. The preference shares will carry a cumulative dividend of 7 per cent., and will be redeemable at 21s. at the option of the company on six months' notice. To provide the new company with working capital, the vendors are to subscribe, in cash at par, for 100,000 preference shares in the same proportion as they become entitled to ordinary shares in accordance with valuation. The Hon. Henry D. McLaren, who is associated with H. D. Pochin, will be the first chairman of the new company, and Mr. Lawson, of the Lovering Co., will be one of the deputy-chairmen. Mr. Martin, of English China Clays, will be the managing director.

Export Trade in Sulphur

SINCE the dissolution of the Sicilian Sulphur Consortium, July 31, there has been considerable conjecture relative to the possibility and effects of open competition for sulphur export trade between the Sicilian producers and the Montecatini Co. and American sulphur exporters. The dissolution alone does not warrant the expectation of disorganised marketing. The consortium was dissolved at the request of its members but since then attempts of organised syndicate selling were considered by certain former consortium members, for example, a substantial tonnage to British acid manufacturers.

German Phosphate Imports

GERMAN imports of phosphates declined sharply during the first half of 1932 as compared with receipts during the corresponding period of 1931. Basic phosphate slag fell 50 per cent. to 383,827 metric tons; phosphate rock receipts of 147,408 tons show a drop of 200,000 tons; while superphosphate importations increased less than 200 tons to 101,581 tons.

Weekly Prices of British Chemical Products

Review of Current Market Conditions

The following notes on the chemical market conditions in Great Britain are based on direct information supplied by the British manufacturers concerned, and unless otherwise qualified the figures quoted apply to fair quantities, net and naked at makers' works. Where no locality is indicated, the prices are general for the United Kingdom. Particulars of the London chemical market are specially supplied to THE CHEMICAL AGE by R. W. Greeff and Co., Ltd., and Chas. Page and Co., Ltd., and those of the Scottish chemical market by Chas. Tennant and Co., Ltd.

THE chemical market has been without special feature this week, the demand continuing on a moderately active scale, with prices remaining very firm. There is no fresh movement in the coal tar products market to report from last week. Stocks are still short, but prices are unchanged. Prices of chemical products have remained generally steady on the Manchester market during the past week and where any indication of easiness is in evidence it is in a limited number of lines that have displayed that tendency for some time. Inquiry this week has been on a moderate scale with actual business still largely confined to relatively near delivery positions. Delivery specifications are circulating for fair quantities. There has been renewed activity in the Scottish heavy chemical market, but prices remain practically unchanged.

General Chemicals

ACETONE.—LONDON: £65 to £68 per ton; SCOTLAND: £66 to £68 ex wharf, according to quantity.

ACID, ACETIC.—Tech. 80%, £37 5s. to £39 5s.; pure 80% £38 5s. to £40 5s.; tech., 40%, £19 15s. to £21 15s.; tech., 60%, £28 10s. to £30 10s. SCOTLAND: Glacial 98/100%, £48 to £50; pure 80%, £38 5s.; tech. 80%, £37 5s. d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £39; tech. glacial, £52.

ACID, BORIC.—SCOTLAND: Granulated commercial, £26 10s. per ton; B.P. crystals, £35 10s.; B.P. powder, £36 10s. in 1-cwt. bags d/d free Great Britain in one-ton lots upwards.

ACID, CHROMIC.—11d. per lb., less 2½%, d/d U.K.

ACID, CITRIC.—1s. 0½d. per lb. LONDON: 11½d. less 5%. MANCHESTER: 10½d.

ACID, CRESYLIC.—97/99%, 1s. 5d. to 1s. 7d. per gal.; 99/100%, 1s. 9d. to 2s.

ACID FORMIC.—London: £48 per ton.

ACID, HYDROCHLORIC.—Spot, 3s. 9d. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s per ton; 50% by weight, £28 10s.; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £53; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £22 to £25 per ton makers' works, according to district and quality. SCOTLAND: 80°, £23 ex station full truck loads.

ACID, OXALIC.—LONDON: £45 10s. per ton in casks, £48 10s. to £52 10s. in kegs. SCOTLAND: 98/100%, £49 to £52 ex store. MANCHESTER: £46, ex store.

ACID, SULPHURIC.—Average prices f.o.r. British makers' works, with slight variations owing to local considerations: 140° Tw. crude acid, £3 per ton; 168° Tw. arsenical £5 10s.; 168° Tw. non-arsenical, £6 15s. SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—11½d. per lb. SCOTLAND: B.P. crystals, 11½d. to 1s., less 5%, carriage paid. MANCHESTER: 10¾d.

ALUM.—SCOTLAND: Lump potash, £9 per ton ex store.

ALUMINA SULPHATE.—LONDON: £8 5s. to £9 10s. per ton. SCOTLAND: £8 to £8 10s. ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb. d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £36 per ton; powdered, £38, in 5-cwt. casks d/d U.K. stations or f.o.b. U.K. ports.

AMMONIUM CHLORIDE.—£37 to £45 per ton, carriage paid. LONDON: Fine white crystals, £19 to £20. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

ANTIMONY OXIDE.—SCOTLAND: Spot, £22 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden 6½d. to 1s. 1½d. per lb.; crimson, 1s. 4d. to 1s. 6d. per lb. according to quality.

ARSENIC.—LONDON: £22 10s. c.o.f. main U.K. ports for imported material; Cornish, nominal, £26 f.o.r. mines. SCOTLAND: White powdered £27 ex wharf; spot, £27 10s. ex store. MANCHESTER: White powdered Cornish, £25 at mines.

ARSENIC SULPHIDE.—Yellow 1s. 6d. to 1s. 8d. per lb.

BARIUM CHLORIDE.—£11 per ton.

BISULPHITE OF LIME.—£7 10s. per ton f.o.r. London, packages free.

BLEACHING POWDER.—Spot 35/37% £7 19s. per ton d/d station in casks, special terms for contract. SCOTLAND: £8 15s. in 5/6 cwt. casks.

BORAX, COMMERCIAL.—Granulated £15 10s. per ton, power £17, packed in 1-cwt. bags, carriage paid any station Great Britain. Prices are for 1-ton lots and upwards.

CADMIUM SULPHIDE.—3s. 4d. to 3s. 7d. per lb.

CALCIUM CHLORIDE.—Solid 70/75% spot £5 5s. to £5 15s. per ton d/d station in drums.

CARBON BISULPHIDE.—£30 to £32 per ton, drums extra.

CARBON BLACK.—4½d. to 5⅞d. per lb., ex wharf.

CARBON TETRACHLORIDE.—£45 to £55 per ton, drums extra.

CHROMIUM OXIDE.—10d. to 10½d. per lb. according to quantity d/d U.K. Green 1s. 2d. per lb.

CHROMETAN.—Crystals 3¾d. per lb. Liquor £19 10s. per ton d/d.

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r, or ex works.

CREAM OF TARTAR.—LONDON: £4 5s. per cwt.

FORMALDEHYDE.—LONDON: £28 per ton. SCOTLAND: 40%, £28 ex store.

LAMPBLACK.—£46 to £50 per ton.

LEAD ACETATE.—LONDON: White, £34 per ton. Brown, £1 per ton less. SCOTLAND: White Crystals £40 to £41 c.i.f. U.K. ports. Brown, £1 per ton less. MANCHESTER: White, £32! Brown, £31.

LEAD NITRATE.—£28 per ton. MANCHESTER: £27 to £28.

LEAD, RED.—SCOTLAND: £28 10s. per ton d/d buyer's works.

LEAD, WHITE.—SCOTLAND: £40 per ton carriage paid.

LITHOPONE.—30%, £19 to £21 per ton.

MAGNESITE.—SCOTLAND: Ground Calcined £9 per ton ex store.

METHYLATED SPIRIT.—61 O.P. Industrial 1s. 8d. to 2s. 3d. gal. Pyridinised Industrial, 1s. 10d. to 2s. 5d. Mineralised, 2s. 9d. to 3s. 3d. 64 O.P. 1d. extra in all cases. Prices according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

NICKEL AMMONIUM SULPHATE.—£52 per ton d/d.

NICKEL SULPHATE.—£52 per ton d/d.

PHENOL.—Small lots 6¼d. to 6½d. per lb. in 3-cwt. drums, bulk quantities down to 5½d. per lb., delivery free U.K.

POTASH, CAUSTIC.—LONDON: £42. MANCHESTER: £39 to £40.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. net d/d U.K. Discount according to quantity. Ground 5¾d. LONDON: 5d. per lb. with usual discounts for contracts. SCOTLAND: 5d. d/d U.K. or c.i.f. Irish Ports. MANCHESTER: 5d.

POTASSIUM CARBONATE.—SCOTLAND: 96/98% spot £28 per ton ex store. LONDON: £31 10s. to £32. MANCHESTER: £30.

POTASSIUM CHLORATE.—3¾d. per lb. ex wharf London in 1-cwt. kegs. LONDON: £37 to £40 per ton. SCOTLAND: 99¾/100% powder, £34. MANCHESTER: £36.

POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.

POTASSIUM NITRATE.—SCOTLAND: Refined Granulated £29 per ton c.i.f. U.K. ports. Spot £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 8¼d. per lb. SCOTLAND: B.P. crystals, 8½d. MANCHESTER: Commercial, 8¼d.; B.P., 8¾d.

POTASSIUM PRUSSIATE.—LONDON: 8¼d. to 9d. per lb. SCOTLAND: Yellow spot material, 8¾d. ex store. MANCHESTER: Yellow, 8¼d.

SALAMMONIAC.—First lump spot, £42 17s. 6d. per ton d/d in barrels.

SODA ASH.—58% spot, £6 per ton f.o.r in bags, special terms for contracts.

SODA, CAUSTIC.—Solid 76/77° spot, £14 10s. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums £18 15s. in casks. Solid 76/77% £14 10s. in drums 70/72% £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £12 15s. to £14 10s. contracts.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£21 to £22 per ton.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND: Refined recrystallised £10 10s. ex quay or station. MANCHESTER: £10 10s.

SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount according to quantity. Anhydrous 5d. per lb. LONDON: 4d. per lb. with discounts for quantities. SCOTLAND: 4d. delivered buyer's premises with concession for contracts. MANCHESTER: 4d. less 1 to 3½% contracts, 4d. spot lots.

SODIUM BISULPHITE POWDER.—60/62%, £16 10s. per ton d/d/ 1-cwt. iron drums for home trade.

SODIUM CARBONATE (SODA CRYSTALS).—SCOTLAND: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality 7s. 6d. per ton extra. Light Soda Ash £7 ex quay, min. 4-ton lots with reductions for contracts.

SODIUM CHLORATE.—£29 per ton.

SODIUM CHROMATE.—3¾d. per lb. d/d U.K.

SODIUM HYPOSULPHITE.—SCOTLAND: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals £15 ex station 4-ton lots. MANCHESTER: Commercial, £9 5s.; photographic, £15.
SODIUM NITRITE.—Spot, £19 to £22 per ton d/d station in drums.
SODIUM PERBORATE.—LONDON: 10d. per lb.
SODIUM PHOSPHATE.—£13 to £15 per ton.
SODIUM PRUSSIATE.—LONDON: 5d. to 5½d. per lb. SCOTLAND: 5d. to 5¾d. ex store. MANCHESTER: 5d. to 6d.
SODIUM SILICATE.—140° Tw. Spot £8 5s. per ton d/d station returnable drums.
SODIUM SULPHATE (GLAUBER SALTS).—£4 2s. 6d. per ton d/d. SCOTLAND: English material £3 15s.
SODIUM SULPHATE (SALT CAKE).—Unground Spot £3 15s. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 2s. 6d.
SODIUM SULPHIDE.—Solid 60/62% Spot, £10 15s. per ton d/d in drums. Crystals Spot £7 15s. per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 2s. 6d. d/d buyer's works on contract, min. 4-ton lots. Spot solid 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11 10s.; commercial, £8.
SODIUM SULPHITE.—Pea crystals spot, £13 10s. per ton d/d station in kegs. Commercial spot £9 10s. d/d station in bags.
SULPHATE OF COPPER.—MANCHESTER: £16 10s. to £17 per ton f.o.b.
SULPHUR.—£12 per ton. SCOTLAND: Flowers, £12 10s.; roll, £12; rock, £9. Ground American, £12 ex store.
SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quality.
SULPHUR PRECIP.—B.P. £55 to £60 per ton according to quantity. Commercial, £50 to £55.
VERMILION.—Pale or deep, 4s. 6d. to 4s. 11d. per lb.
ZINC CHLORIDE.—SCOTLAND: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.
ZINC SULPHATE.—LONDON and SCOTLAND: £12 per ton.
ZINC SULPHIDE.—1s. to 1s. 2d. per lb.

Pharmaceutical and Fine Chemicals

ACID, TARTARIC.—10¾d. per lb.
BISMUTH SALTS.—Carbonate, 6s. 6d. per lb.; citrate, 8s. 10d.; nitrate (cryst.), 4s. 4d.; oxide, 10s.; salicylate, 7s. 3d.; subchloride, 9s. 10d.; subgallate, 6s. 11d.; subnitrate, 5s. 8d.
PHENOLPHTHALEIN.—4s. to 5s. per lb.
POTASSIUM BITARTRATE, 99/100% (Cream of Tartar).—£4 5s. per cwt.
SODIUM BENZOATE, B.P.—1s. 7d. per lb.
SODIUM CITRATE, B.P.C. 1911.—1s. 3d. per lb.; B.P.C. 1923 and U.S.P., 1s 7d per lb.
VANILLIN.—Ex clove oil, 16s. to 18s. per lb. Ex Guaiacol, 14s. 3d. to 16s. 3d. per lb., including packing and delivery free U.K.

Essential Oils

ANISE.—2s. 2d. per lb.
CAMPHOR, WHITE.—90s. per cwt.
CANANGA, JAVA.—8s. per lb.
CASSIA, 80/85%.—4s. 9d. per lb.
CITRONELLA OIL, JAVA.—3s. 1½d. per lb.; CEYLON, 2s. 3d. per lb.
EUCALYPTUS, AUSTRALIAN B.P., 70 75%.—1s. 1d. per lb.
LEMONGRASS.—2s. 9d. per lb.
PEPPERMINT.—Japanese, 4s. 4½d. per lb., Wayne County, 13s. per lb.

Intermediates and Dyes

In the following list of Intermediates delivered prices include packages except where otherwise stated:—
ACID, BENZOIC, B.P. (ex Toluol).—1s. 9½d. per lb.
ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.
ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.
ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100% d/d buyer's works.
ACID, SULPHANILIC.—Spot, 8d. per lb. 100% d/d buyer's works.
ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.
ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.
BENZALDEHYDE.—Spot, 1s. 8d. per lb., packages extra.
BENZIDINE BASE.—Spot, 2s. 5d. per lb. 100% d/d buyer's works.
o-CRESOL 30/31° C.—£2 6s. 5d. per cwt., in 1-ton lots.
m-CRESOL 98/100%.—2s. 3d. per lb., in ton lots.
p-CRESOL 34.5° C.—1s. 9d. per lb., in ton lots.
DICHLORANILINE.—2s. per lb.
DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.
DINITROBENZENE.—8½d. per lb.
DINITROTOLUENE.—48/50° C., 8½d. per lb.; 66/68° C., 9d. per lb.
DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.
α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.
β-NAPHTHOL.—Spot, £75 per ton in 1-ton lots, d/d buyer's works.
α-NAPHTHYLAMINE.—Spot, 11½d. per lb., d/d buyer's works.
β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb. d/d buyer's works.
o-NITRANILINE.—5s. 10d. per lb.
m-NITRANILINE.—Spot, 2s. 7d. per lb. d/d buyer's works.
p-NITRANILINE.—Spot, 1s. 8d. per lb. d/d buyer's works.
NITROBENZENE.—Spot, 5d. per lb.; 5-cwt. lots, drums extra.
NITRONAPHTHALENE.—9d. per lb.
SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb.
o-TOLUIDINE.—Spot, 9½d. per lb., drums extra, d/d buyer's works.
p-TOLUIDINE.—Spot, 1s. 11d. per lb., d/d buyer's works.
m-XYLIDINE ACETATE.—3s. 6d. per lb., 100%.

Coal Tar Products

ACID, CARBOLIC (CRYSTALS).—6d. to 6¾d. per lb. Crude, 60's 1s. 5¼d. to 1s. 6¼d. per gal. 2% water, 1s. 9d. per gal. SCOTLAND: Sixties, 1s. 7d. to 1s. 8d.
ACID, CRESYLIC.—99/100, 1s. 7d. per gal.; B.P., 1s. 10d. to 2s.; Refined, 1s 8d. to 1s. 10d.; Pale, 98%, 1s. 6d. to 1s. 7d.; Dark, 1s. 3d. to 1s. 4d. LONDON: 98/100%, 1s 6d. Dark 95/97%, 1s. 4d. SCOTLAND: Pale 99/100%, 1s. 3d. to 1s. 4d.; 97/99%, 1s. to 1s. 1d.; dark 97/99%, 11d. to 1s.; high boiling acid, 2s. 6d. to 3s.
ANTHRACENE OIL.—Strained, 4¾d. per gal.
BENZOL.—At works, crude, 10d. to 11d. per gal.; standard motor, 1s. 6½d. to 1s. 7d.; 90%, 1s. 7d. to 1s. 8d.; pure, 1s. 10d. to 1s. 11d. LONDON: Motor, 1s. 7½d. SCOTLAND: Motor, 1s. 6½d. to 1s. 7½d.; 90%, 2s. 0½d. to 2s. 1½d.
CREOSOTE.—Standard for export, 4½d. to 5d. nett per gal. f.o.b. for Home, 3¾d. d/d. LONDON: 3d. to 3½d. f.o.r. North; 4d. to 4½d. London. MANCHESTER: 3d. to 4d. SCOTLAND: Specification *oils*, 3¾d to 4¼d.; *washed oil*, 4d. to 4½d.; *light*, 3¾d. to 4¼d.; heavy, 4½d. to 5d.
NAPHTHA.—Solvent, 90/160, 1s. 4d. to 1s. 5d. per gal.; 95/160, 1s. 8d.; 90/190, 1s. 1d. to 1s. 2d. LONDON: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r SCOTLAND: 90/160, 1s. 3d. to 1s. 3½d.; 90/190, 11d. to 1s. 2d.
NAPHTHALENE.—Crude, Hot-Pressed, £6 1s. 3d. per ton. Flaker, £10 per ton. Purified crystals, £9 10s. per ton in bags. LONDON: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. SCOTLAND: 40s. to 50s.; whizzed, 65s. to 70s.
PITCH.—Medium soft, £4 7s. 6d. to £5 per ton.
PYRIDINE.—90/140, 3s. 9d. per gal.; 90/160, 4s. to 4s. 6d.; 90/180, 2s. to 2s. 6d. SCOTLAND: 90/160%, 4s. to 5s.; 90/220%, 3s. to 4s.
REFINED COAL TAR.—SCOTLAND: 4¾d. to 5d. per gal.
XYLOL.—1s. 9d. to 2s. per gal.; Pure, 1s. 10d. to 2s. 2d.
TOLUOL, 90%.—2s. to 2s. 4d. per gal.; Pure, 2s. 6d. to 2s. 8d. per gal.

Wood Distillation Products

ACETATE OF LIME.—Brown, £8 10s. per ton. Grey, £10 10s. to £12. Liquor, brown, 30° Tw., 6d. per gal. MANCHESTER: Brown, £8 10s.; grey, £11 5s.
ACETIC ACID, TECHNICAL, 40%.—£16 10s. to £18 10s. per ton.
AMYL ACETATE, TECHNICAL.—95s. to 110s. per cwt.
CHARCOAL.—£6 10s. to £11 per ton.
WOOD CREOSOTE.—6d. to 2s. per gal., unrefined.
WOOD NAPHTHA, MISCIBLE.—2s. 6d. to 4s. per gal. Solvent, 3s. 9d. to 4s. 9d. per gal.
WOOD TAR.—£2 to £6 per ton.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—The export market remains quiet, but the price is firmly held at £4 12s. 6d. per ton f.o.b. U.K. port in single bags for October shipment. As this is the off season there is very little interest in the home market. The price continues unchanged at £5 5s. per ton delivered in 6-ton lots to farmers' nearest station.
NITRATE OF SODA.—The price remains unchanged at £8 9s. per ton for October delivery, for 6-ton lots delivered to consumers' nearest station.
NITRO-CHALK.—The price of £7 5s. per ton delivered in 6-ton lots remains in force. It is reported that there has been some buying for spring delivery.

Latest Oil Prices

LONDON, October 4.—LINSEED OIL was barely steady. Spot, small quantities, £20; Oct., £16 17s. 6d.; Nov.-Dec., £17 10s.; Jan.-April, £18; May-Aug., £19 per ton, naked. RAPE OIL was slow. Crude, extracted, £29; technical refined, £31 per ton, naked, ex wharf. COTTON OIL was dull. Egyptian, crude, £23; refined common edible, £26; and deodorised, £28 per ton, naked, ex mill. TURPENTINE was easy. American spot, 61s. 6d. per cwt.
HULL.—LINSEED OIL, spot, closed at £17; Oct. and Nov.-Dec., £16 10s.; Jn.-April, £17 10s.; May-Aug., £18 10s. COTTON OIL.—Egyptian, crude, spot, £23; edible, refined, spot, £25 10s.; technical, spot, £25 10s.; deodorised, £26 10s., naked. PALM KERNEL OIL.—Crude, f.m.q., spot, £22 10s., naked. GROUNDNUT OIL.—Crushed/extracted, spot, £31; deodorised, £35. RAPE OIL.—Crushed/extracted, spot, £28 10s.; refined, £30. SOYA OIL.—Crushed/extracted, spot, £23; deodorised, £26 per ton. COD OIL, 15s. 6d. per cwt. CASTOR OIL.—Pharmacy, spot, 42s.; first, 37s.; second, 32s. per cwt. TURPENTINE.—American, spot, 64s. per cwt.

Inventions in the Chemical Industry

Specifications Accepted and Applications for Patents

The following information is prepared from the Official Patents Journal. Printed copies of Specifications Accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

De-fraying Treatment for Fabrics

FABRICS are treated with a composition consisting of pyroxylin, an ester of phthalic acid, a solvent and a softening agent, in order to prevent ravelling at the edges thereof, or to increase their resistance to wear, washing, pressing, cleaning and other influences or processes. The preferred composition contains pyroxylin, an ester of phthalic acid, preferably di-ethyl phthalate, dissolved in a solvent such as methyl alcohol and benzine, and a softening agent such as castor oil or tricresyl phosphate. The composition is of the consistency of a jelly or paste, and may be applied by brushing, spraying or spreading. (See Specification No. 374,983 of M. Goldberg.)

Purifying Sulphur

SULPHUR is freed from arsenic by treating it in the vapour phase with a molten reagent consisting initially of an alkali sulphide or polysulphide or both, or of compounds, such as alkali hydroxides or carbonates, which will react with the sulphur to form the sulphides. The sulphur vapour may be contained in gases derived in the formation of sulphur, *e.g.*, from pyrites or sulphur dioxide, or may be produced by the distillation of crude sulphur. Preferably, the sulphur vapour or the gas containing it is bubbled through the molten sulphide or polysulphide at a temperature of 250° C. or over, or the gases may be passed over inert material impregnated or irrigated with the sulphide. In an example, sulphur having 5,000 parts of arsenic per million contained only 5 parts after treatment. (See Specification No. 372,781 of J. S. Dunn and Imperial Chemical Industries, Ltd.)

Manufacture of Alkali Dichromates

ALKALI dichromates are obtained by treating alkali chromates in the aqueous phase and in the presence of the requisite quantity of chromium oxide or hydroxide or of metallic chromium or its alloys with oxygen or gases containing it under pressure at temperatures above 100° C., say at 250-300° C. In one example a chromium ore is treated with fused caustic soda in the presence of iron oxide or roost residue at 450-500° C. to obtain chromate. A part of the product is reduced bp hydrogen under pressure in the presence of water at 280°-300° C. with air or oxygen under recovered mixed with further chromate and treated in the presence of water at 280-200° C. with air or oxygen under pressure to obtain a solution of sodium dichromate. (See Specification No. 371,059, of Bozel-Maletra, Soc. Industrielle de Produits Chimiques.)

Removing Iron from Nickel Solutions

A PROCESS for the removal of iron from nickel salt solutions by hydrolysis in which the solution is first neutralised and then blown with air is characterised in that neutralisation is effected by a strongly reactive metallic nickel product obtained by gas reduction of nickel compounds at low temperatures, preferably from 350-450° C. Hydrogen or water gas are specified for the reduction. The nickel serves also to cement copper present. The process, which is effected below 60° C., is of general application, but a special application is described, wherein nickel-copper matte is ground, roasted to remove sulphur and leached with acid for the partial removal of copper. Part of the leached residue is reduced under the specified conditions to obtain a nickeliferous metallic powder. The remainder is converted to metal and cast into anodes for use in an electrolytic cell, which is divided into cathode and anode compartments by a filter diaphragm, through which the electrolyte at about 50° C. flows from the former to the latter. The solution escaping from the anode compartment is purified by the present process employing the nickeliferous powder obtained as above, and is returned to the cathode compartment. The exhausted nickeliferous material is mixed with the ground matte and re-used. (See Specification No. 372,958 of Falconbridge Nikkelverk Antieselkap.)

Purifying Clay

CERAMIC raw materials such as clay, soapstone or kaolin are purified and rendered more plastic by treatment with sodium or potassium chloride, and particularly with a normal solution of potassium chloride. An acid treatment, for instance with N/10 hydrochloric acid, may precede or follow or be effected simultaneously with the treatment with the salt, and the reaction may be promoted by heat. Course impurities such as mica may be first removed by making the clay into a slip with addition of waterglass. Iron and aluminium salts may be recovered from the used washing liquids. (See Specification No. 373,520 of Deutscheton- and Steinzeug-Werke.)

Sterilising Organic Material

ORGANIC material is sterilised by ultra-violet rays whilst at a very low temperature. Animal, fish or vegetable matter is frozen solid by immersion in a non-freezing refrigerant or by evaporation of liquid air or the like, the frozen material is mechanically crushed, and then subjected to a preliminary partial dessication by subjection to pressure sufficiently high to liquefy water at the low temperature employed at this stage, preferably −18° to −40° C. A salt, such as a chloride of sodium, calcium or magnesium, or a liquid, such as alcohol, or glycerin, serving to lower the freezing-point of water may be added during this step, and the mixture subjected to sterilisation by ultra-violet rays. (See Specification No. 373,658 of H. L. P. Tival.)

Manufacture of Ash-Free Carbon

ASH-FREE carbon is obtained from purified lignin by carbonising it by a wet method either before treatment with an alkali or after treatment first with an acid and then with an alkali. The lignin may be precipitated from waste cellulose lye by an acid, preferably hydrochloric acid, or produced from cellulosic material from which colophony may be removed by turpentine, the lignin being then washed with warm water. In an example, purified lignin is carbonised by heating with sulphuric acid of 65° Baumé for about 12 hours at 165 to 200° C. After removal of excess sulphuric acid, the mass is treated with a solution containing 4 parts of sodium carbonate and 1 of potassium carbonate until the silicates are removed, washed with warm water, treated with concentrated hydrochloric acid for 8 to 12 hours and then washed with warm water. After washing and drying the carbon is ground, further treated with sulphuric acid, washed and dried. (See Specification No. 372,336 of Soc. Carbonifix.)

Stabilising Ammonium Sulphate-Nitrate

AMMONIUM sulphate-nitrate is rendered stable for storage, particularly for the fertiliser industry, by adding thereto urea and non-deliquescent salts which in a dehydrated state are capable of combining with water of crystallisation. Salts of magnesium, aluminium, iron in the ferrous or ferric state and Glauber's salt are specified. Preferably about one part urea per three parts of salt is employed, ¼-10 per cent. by weight of urea being used. The mixture may be added to the ammonia sulphur-nitrate at any time during its preparation. In examples, urea is added to a solution of ferrous sulphate, and the mixture added to an agitated mixture of ammonium sulphate and nitrate; hydrated aluminium sulphate or dehydrated magnesium nitrate and urea are added to ammonium sulphate-nitrate; a hot solution of Glauber's salts and urea is sprayed on to ammonium sulphate-nitrate with mixing. The mass is dried in some cases, for instance, at 100° C. (See Specification No. 372,388 of J. Y. Johnson, a communication from I. G. Farbenindustrie.)

Specifications Accepted with Dates of Applications

METHOD OF AND APPARATUS FOR THE PRODUCTION OF MOULDED ARTICLES FROM ARTIFICIAL RESIN AND ARTIFICIAL-RESIN-CONTAINING MIXES. P. Kopp. Nov. 7, 1930. 380,825.

MANUFACTURE OF SILICA GEL AND LIKE ADSORBENT OXIDE GELS. W. J. Tennant (*Silica Gel Corporation*). April 14, 1931. 380,796.

PROCESS FOR COLOURING HARDENED MASSES FROM CASEIN. Internationale Galalith-Ges, Hoff and Co. Sept. 2, 1930. 380,826.

CRYSTALLINE ANHYDROUS CITRIC ACID, AND METHOD OF MAKING SAME. C. Pfizer and Co. Jan. 7, 1931. 380,813.

STAINLESS CHROMIUM-NICKEL STEEL ALLOYS. F. Krupp Akt.-Ges. June 30, 1930. 380,805.

PRODUCTION OF ARTIFICIAL MATERIALS BY WET SPINNING PROCESSES FROM SOLUTIONS OF ORGANIC DERIVATIVES OF CELLULOSE. British Celanese, Ltd., W. A. Dickie, and P. F. C. Sowter. June 23, 1931. 380,819.

PROCESS FOR REFINING AND HOMOGENISING A SOAP BASE. Lever Bros. Co. June 24, 1930. 380,820.

SURFACE TREATMENT OF PLASTERS AND CEMENTS. V. Lefebure, and Imperial Chemical Industries, Ltd. June 23, 1931. 380,821.

MANUFACTURE OF CELLULOSE ESTERS. A. G. Bloxam (*Soc. of Chemical Industry in Basle*). June 23, 1931. 380,822.

SULPHONATED VEGETABLE OIL PRODUCTS. Imperial Chemical Industries, Ltd., T. Callan, and R. P. McGlynn. June 24, 1931. 380,836.

PROCESS FOR THE MANUFACTURE OF STABLE DERIVATIVES OF A BARBITURIC ACID. A. Carpmael (*I. G. Farbenindustrie*). June 24, 1931. 380,841.

TEXTILE PRINTING BY MEANS OF VAT-DYESTUFF PREPARATIONS. I. G. Farbenindustrie. June 27, 1930. 380,860.

MANUFACTURE OF DERIVATIVES OF BENZYLISOQUINOLINE. Chinoin Fabrik-Chemisch-Pharmaceutischer Produkte A.-G., and Dr. E. Wolf. Aug. 1, 1930. 380,874.

PROCESS FOR THE RECOVERY OF TIN, OR LEAD, OR ANTIMONY, OR BISMUTH, OR ALLOYS OF TWO OR MORE OF THESE METALS WITH OR WITHOUT PRECIOUS METALS. A. L. Mond (*Berzelius Metallhütten Ges.*). July 20, 1931. 380,884.

PROCESS FOR THE MANUFACTURE OF CARBON AND HYDROGEN. N. Grunstein. July 25, 1930. 380,893.

MANUFACTURE OF REACTION PRODUCTS OF HYDROXY DIPHENYLS AND AMINO MATERIALS. Goodyear Tire and Rubber Co. Dec. 18, 1930. 380,898.

MANUFACTURE OF INDIGOID VAT DYESTUFFS. I. G. Farbenindustrie. Aug. 1, 1930. 380,902.

MANUFACTURE OF PLASTIC MASSES FROM CELLULOSE ACETATES. Lonza Elektrizitätswerke und Chemische Fabriken A.-G. Oct. 9, 1930. 380,950.

PROCESS OF PREPARING PURE COMPONENTS OF GROUPS OF COMPONENTS FROM A MIXTURE OF LIQUIDS. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Nov. 18, 1930. 380,954.

MANUFACTURE OF PHOSPHORUS IN BLAST FURNACES. E. Urbain. Oct. 6, 1930. 380,955.

PROCESS FOR OBTAINING SOLID PURE NAPHTHALENE AND SIMILAR SOLID PURE SUBSTANCES FROM THE MOLTEN SUBSTANCES. Ges für Teerverwertung, Dr. F. Kraft and Dr. S. Müller. Nov. 14, 1931. 380,990.

ABSORPTION OF NITROGEN-OXIDE-CONTAINING GASES MIXED WITH OXYGEN OR AIR. A. Mentzel. Jan. 16, 1931. 381,009.

PRODUCTION OF ORGANIC BROMINE COMPOUNDS. Kali-Forschungs-Anstalt Ges. Dec. 16, 1931. 381,070.

PROCESS FOR THE MANUFACTURE OF HYDROGEN FROM HYDROCARBONS. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Feb. 28, 1931. 381,072.

PROTECTION OF MAGNESIUM AND HIGH-GRADE MAGNESIUM ALLOYS FROM THE ACTION OF CORRODING AGENTS. I. G. Farbenindustrie. March 10, 1931. 381,088.

PROCESS FOR THE MANUFACTURE OF VAT-DYESTUFFS OF THE ANTHRAQUINONE SERIES. I. G. Farbenindustrie. March 12, 1931. 381,090.

MANUFACTURE OF A STABLE CHLORO RUBBER. I. G. Farbenindustrie. March 30, 1931. 381,098.

PROCESS FOR THE MANUFACTURE OF METALLIC MAGNESIUM FROM MAGNESIUM OXIDE. Osterreichisch Amerikanische Magnesit A.-G. July 8, 1931. 381,115.

Complete Specifications open to Public Inspection

METHOD OF AND APPARATUS FOR THE CONTINUOUS REFINING OF HYDROCARBONS. Aktiebolaget Separator-Nobel. Sept. 25, 1931. 23177/32.

VINYL RESINS AND PROCESSES FOR PRODUCING THE SAME. Carbide and Carbon Chemicals Corporation. Sept. 25, 1931. 23662/32.

PHOTOGRAPHIC ANTI-HALATION LAYER. I. G. Farbenindustrie. Sept. 22, 1931. 24417/32.

PROCESS FOR THE MANUFACTURE OF 2- AND 4-HYDROXY-3.5-DIHODOPYRIDINE-MONOCARBOXYLIC ACIDS. Schering-Kahlbaum A.-G. Sept. 22, 1931. 25829/32.

MANUFACTURE OF DISAZO-DYESTUFFS CONTAINING COPPER. I. G. Farbenindustrie. Sept. 21, 1931. 26141/32.

PROCESS FOR THE REFINING OF NATURAL ORGANIC PRODUCTS. L. Rosenstein and W. J. Hund. Sept. 22, 1931. 26183/32.

MANUFACTURE OF SULPHURIC ACID ESTERS OF LEUCO DERIVATIVES OF VAT DYESTUFFS. I. G. Farbenindustrie. Sept. 21, 1931. 26257/32.

MANUFACTURE OF CARBO-CYANINE DYES AND INTERMEDIATE PRODUCTS. Kodak, Ltd. Sept. 21, 1931. 26261/32.

PROCESS OF SENSITISING PHOTOGRAPHIC EMULSIONS. Kodak, Ltd. Sept. 21, 1931. 26262/32.

MANUFACTURE OF ACYL ACETIC HYDROXYARYLAMIDES. I. G. Farbenindustrie. Sept. 23, 1931. 26384/32.

PROCESS OF AND APPARATUS FOR THE PRODUCTION OF SOLID CARBON DIOXIDE OR ANALOGOUS SOLID SUBSTANCES DERIVED FROM COMMERCIALLY LIQUIFIABLE GASES SUCH AS ACETYLENE BUTANE, METHYL-CHLORIDE OXYGEN, OR AMMONIA, OR COMPATIBLE MIXTURES OF EASILY LIQUEFIABLE GASES. W. Hessling. Sept. 22, 1931. 26422/32.

PROCESS FOR OBTAINING OIL FROM SEA ANIMALS AND OIL-RICH FISH. J. O. Nygaard. Sept. 24, 1931. 26500/32.

MANUFACTURE OF ACID-WOOL DYESTUFFS OF THE ANTHRAQUINONE SERIES. I. G. Farbenindustrie. Sept. 26, 1931. 26685/32.

Applications for Patents

APPARATUS FOR TESTING FASTNESS TO LIGHT OF DYES, ETC. Ontario Research Foundation. Sept. 22. (Canada, June 11.) 26340

MANUFACTURE OF ESTERS FROM ALDEHYDES, ETC. Dr. A. Wacker Ges. für Elektrochemische Industrie Ges. Sept. 19. (Germany, April 25.) 26007.

PURIFICATION OF SEWAGE, ETC. Activated Sludge, Ltd., and J. A. Coombs. Sept. 29. 27062.

COLOURATION OF MATERIALS. British Celanese, Ltd., G. H. Ellis and H. C. Olpin. Oct. 1. 27293.

WATER SOFTENING. Clensol, Ltd., and W. H. Piper. Sept. 27. 26806.

ELECTRODEPOSITION OF METALS. S. O. Cowper-Coles. Sept. 28. 26893.

WATER SOFTENING APPARATUS. S. A. Dean. Sept. 26. 26648.

REMOVING COLLOIDAL SUBSTANCES FROM LIQUIDS. J. Dedek and J. Vasatko. Sept. 26. Czecho-Slovakia, Sept. 25, '31.) 26721. 26721.

CATALYTIC SYNTHESIS OF AMINES. Goodyear Tire and Rubber Co. Oct. 1. (United States, June 27.) 27331.

CATALYTIC SYNTHESIS OF AMINES. Goodyear Tire and Rubber Co. Oct. 1. (United States, June 28.) 27332.

CATALYTIC THERMAL CONVERSION OF COAL, OIL, OR WATER GASES INTO BENZOL, ETC. C. J. Greenstreet. Sept. 28. 26976.

MANUFACTURE OF HALOGEN DERIVATIVES OF AROYL PHENYL CARBOXYLIC ACIDS, ETC. W. W. Groves (*I.G. Farbenindustrie*). Sept. 30. (Dec. 29, '31.) 27135.

PRODUCTION OF ETHYLENE FROM ETHYL ALCOHOL, ETC. G. F. Horsley and Imperial Chemical Industries, Ltd. Sept. 26. 26660.

WEIGHTING ANIMAL FIBRES. J. Y. Johnson (*I. G. Farbenindustrie*). Sept. 26. (May 21.) 26665.

MANUFACTURE OF AZO DYESTUFFS. J. Y. Johnson (*I. G. Farbenindustrie*). Sept. 29. 27049.

MANUFACTURE OF CONDENSATION PRODUCTS FROM PHENYLS AND ACETYLENE. J. Y. Johnson (*I. G. Farbenindustrie*). Sept. 29. 27050.

CONVERTING SALT MIXTURES CONTAINING AMMONIUM CPHLORIDE INTO GRANULAR FORM. J. Y. Johnson (*I. G. Farbenindustrie.*) Sept. 29. 27051.

MANUFACTURE OF AZO DYESTUFFS CONTAINING METALS. J. Y. Johnson (*I. G. Farbenindustrie*). Sept. 29. 27052.

MANUFACTURE OF PHOSPHATE FERTILISERS. J. Y. Johnson (*I. G. Farbenindustrie*). Sept. 30. 27200.

MANUFACTURE OF SODIUM HYDROSULPHITE. J. Y. Johnson (*I. G. Farbenindustrie*). Sept. 30. 27202.

MANUFACTURE OF ACID WOOL DYESTUFFS OF ANTHRAQUINONE SERIES. I. G. Farbenindustrie. Sept. 26. (Germany, 26, '31.) 26685.

MANUFACTURE OF NEW AZO DYESTUFFS CONTAINING COPPER. I. G. Farbenindustrie. Sept. 27. (Germany, Sept. 28, '31.) 26830.

MANUFACTURE OF POLYMORPHOUS SUBSTANCES IN A DISTINCT CRYSTAL FORM. I. G. Farbenindustrie. Sept. 30. (Germany, Oct. 1, '31.) 27230.

PRODUCTION OF HYDRATED LIME. Imperial Chemical Industries, Ltd., and F. P. Stowell. Sept. 27. 26825.

PLASTIC MATERIALS. Imperial Chemical Industries, Ltd., and D. T. Jones. Sept. 28. 26920.

MANUFACTURE OF SOLUTIONS OF CELLULOSE DERIVATIVES, ETC. Imperial Chemical Industries, Ltd. Sept. 29. 27087, 27088.

AZO DYESTUFFS. W. E. Kemmerich. Sept. 29. (United States, Sept. 29, '31.) 27092.

TREATING OXIDISED ORES. Meyer Mineral Separation Co. Sept. 26. (United States, Oct. 7, '31.) 26659.

ELECTROLYTIC TREATMENT OF METAL ALLOYS. Mond Nickel Co., Ltd. Sept. 29. 27111.

MANUFACTURE OF COMMERCIAL SILICATE OF SODA SOLUTIONS. C. W. Moore. Sept. 27. 26846.

PRODUCTION OF ALCOHOLS. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Sept. 30. (Holland, Oct. 17, '31.) 27227.

PRODUCTION OF ALCOHOLS. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Sept. 30. (Holland, Oct. 21, '31.) 27228.

METHODS OF MAKING PLASTIC ELASTIC MATERIALS. Naugatuck Chemical Co. Sept. 26. (United States, Oct. 27, '31.) 26728.

PURIFICATION OF OILS CONTAINING FREE FATTY ACID. Sharpes Speciality Co. Sept. 28. (United States, Oct. 6, '31.) 26942.

MANUFACTURE OF TITANIUM COMPOUNDS. Titanium Pigment Co., Inc. Oct. 1. (United States, Oct. 16, '31.) 27319.

From Week to Week

MR. L. PHILLIPS has resigned from the directorate of Goodlass, Wall and Lead Industries, Ltd.

BABCOCK AND WILCOX, LTD., announce that Mr. Archibald McKinstry has been appointed managing director and Lt.-Col. J. H. M. Greenly, deputy-chairman.

SIR C. V. RAMAN has been appointed director of the Indian Institute of Science, Bangalore, on the retirement of Dr. M. O. Forster, in April, 1933.

MR. LESLIE ERNEST SUTTON has been elected by the president and fellows of Magdalen College, Oxford, to a fellowship by examination in organic chemistry. Mr. Sutton was a scholar of Lincoln College, and obtained a first class in the Honour School of Chemistry in 1928. He has been assisted by various research grants from the Department of Scientific and Industrial Research.

MOTORISTS ARE REMINDED by the Automobile Association that sugar beet is now being harvested in many parts of the country, particularly in East Anglia. Occasionally, the beet is inadvertently dropped from lorries on to the road with consequent danger to traffic after dark. The A.A. issues a special warning to motor cyclists to be on their guard against this danger when passing through agricultural districts.

SIR MICHAEL SADLER, formerly vice-chancellor of Leeds University and now master of University College, Oxford, is to be presented with an illuminated address at Barnsley on October 10, when Barnsley's new Mining and Technical College will be opened. This college has been erected and equipped at a cost of £100,000, and Sir Michael, who was born at Barnsley, will speak at the opening ceremony.

INCLUDED IN A NUMBER OF NEW DUTIES recently imposed by the Government of the Irish Free State are all articles in the nature of food or medicine for internal use for all animals, which pass under the designation of a proprietary or protected name. Foods and medicines imported by weight are dutiable at the rate of 42s. per cwt., with an imperial preferential rate of 28s. per cwt., imports by measure, 3s. 9d. per gal., imperial preferential rate, 2s. 6d. per gal.

THE COKE OVEN MANAGERS' ASSOCIATION is holding its annual general meeting and dinner at the Hotel Great Central, Marylebone, London, on Thursday, October 20, when Mr. Geo. T. Purves will deliver his presidential address. On the following day there will be a visit to the new coke oven installation at Beckton gasworks, by the courtesy of the Gas Light and Coke Co. A further visit will be made on Saturday morning, October 22, through the courtesy of General Electric Co., Ltd., to see a demonstration of the Chance sand flotation system of cleaning coal, at the works of Fraser and Chalmers, Erith, Kent.

AT ENNIS, COUNTY CLARE, a recently-registered Irish company, Irish Whiting Manufacturers, Ltd., has acquired mills for the manufacture of superfine whiting. Work commenced on September 26 and abundant quantities of calcium carbonate are available in the limestone deposits of County Clare. A number of orders have already been received by the new company and analytical reports on its product are stated to be favourable. Fifty men are at present employed in the industry in Ennis, but a representative of the firm, Mr. L. W. Carder, stated that he anticipated the employment of at least fifty more within six months and a full strength of between two and three hundred after a year or so of operation.

MR. ALFRED RUDGE, general works manager of Allhusen's Chemical Works, Newcastle, has entered upon his retirement. The works, amongst the most famous of the Tyneside chemical concerns, are being dismantled as part of the centralisation scheme of the Imperial Chemical Industries, Ltd., of which they form a part. Mr. Rudge, a popular figure in the industry, came to Tyneside as works manager in November, 1914, after having worked with the United Alkali Company at St. Helens for 24 years. During the war he played a big part in the production of munitions, and it was at Allhusen's that the first successful production of the phosgene gas was carried out. For two years Mr. Rudge was chairman of the Newcastle Section of the Society of Chemical Industry.

TURNER AND NEWALL, LTD., announce that as and from October 1, they are consolidating all subsidiary companies which deal exclusively with the sale and application of insulating materials into one organisation, which will be a branch of the parent company, and will trade as "Newalls Insulation Co." The consolidated organisation will have headquarters at Washington Station, Co. Durham, and a chain of branch offices and warehouses throughout the country. The aim of the reorganisation is reduction of administrative expenses, without curtailing local enterprise and direct touch with customers, but by grouping small offices and works into larger units. The subsidiary companies concerned are: Thomas Anderson, Ltd., Carbon Cement Co., Ltd., Hobdell, Way and Co., Ltd., Newalls Insulation Co., Ltd., Newalls Insulation Export Co., Ltd., Reid McFarlane and Co., Ltd., Reid McFarlane and Co. (Belfast), Ltd., Reid McFarlane (London), Ltd., and Sutcliffe Bros. and Bryce, Ltd.

JOHN EDWARD LENNARD JONES, Ph.D., Plummer Professor of Inorganic Chemistry, Cambridge University, has been elected a Fellow of Corpus Christi College.

IT HAS BEEN ANNOUNCED that Lord Melchet has decided to give the remaining part of his late father's library to Witwatersrand University, Johannesburg.

CHEMICALS AND DYESTUFFS are included in the exhibits at an exhibition of textile machinery, accessories, yarns and fabrics which opened at the Granby Halls, Leicester, yesterday (Friday). The exhibition will remain open until October 15.

A JOINT MEETING of the Edinburgh and East of Scotland Sections of the Society of Chemical Industry and Institute of Chemistry will be held at the North British Station Hotel, Edinburgh, on October 20, at 8 p.m. Dr. W. O. Kermack, chairman of the local section of the Society of Chemical Industry, will deliver his inaugural address on "Some Recent Work on the Chemistry of Proteins."

NORTHERN PLATINUM EXPLORATION, LTD., in voluntary liquidation, announces that all shareholders, whether registered or not, should, in order to participate in any liquidation dividends, lodge their shares with the liquidators, at the transfer office of the company, Anmercosa House, Hollard Street (P.O. Box 1048), Johannesburg, or with the London agents of the liquidators at 5 London Wall Buildings, E.C.2.

THE VALUE OF THE CHEMICALS, drugs, perfumery, dyes and colours imported into the Irish Free State during August, 1932, was £71,002, a sharp decline on the figures for the corresponding month of 1931 when the value was £82,902. The fall is ascribed to the tariffs imposed by the Government of the Free State. Chemical fertilisers imported during the same month were valued at £41,630, as against £43,225 in August of last year.

COUNCILLOR G. CAMPBELL, of Darlington, has been invited by the Darlington General Purposes Committee to be the town's next Mayor. Councillor Campbell, who has been a member of the council for seven years, is a member of the firm of Ferguson, Wild and Co., iron ore merchants, Darlington, and a director of the Chemical and Insulating Co., Ltd., Darlington, and the Eston Steel and Galvanising Co., Ltd., Darlington. He is also an underwriter at Lloyds.

A NEW SCHEME OF PART-TIME DAY TRAINING for employees of the rubber industry has been developed at Aston Technical College, Birmingham, and is expected to be in operation early in October. Provision has been made for attendance at the college during two half-days every week and one evening, and the length of the course, as at present arranged, is two years. The syllabus includes such subjects as rubber technology, properties of rubber materials, engineering science, mathematics and English. In the latter subject attention is paid to the importance of spoken English. It is also proposed to include workshop practice of a general nature, in order that students may obtain experience of the ordinary machines of the engineering workshop.

THE FUNERAL OF THE LATE PROFESSOR THOMAS GRAY, of the Royal Technical College, Glasgow, took place at Elie Churchyard on September 29. Prior to the interment a large company of mourners, representative of Professor Gray's many activities, assembled in the church. Among the mourners from the Royal Technical College, Glasgow, were Professor Wilson, Professor Cavan, Professor Parker Smith, Professor Mellanby, Dr. Cruickshanks, Dr. Sutherland, Dr. Gordon, Dr. Crawford, and Mr. Buchanan. Dr. H. F. Stockfield was unable to be present. Other institutions represented were the Andersonian Chemical Society, the Society of Chemical Industry, Institute of Chemistry, Department of Scientific and Industrial Research, and the Scottish Oils, Ltd.

A MEETING of the Chemical Engineering Group of the Society of Chemical Industry will be held on Friday, October 14, at 8 p.m., in the rooms of the Chemical Society, Burlington House, Piccadilly. A paper on "Colloidal or Coal-Oil Fuel" will be read by Professor J. S. S. Brame. An experiment was made a few months ago on a coal and oil mixture as a fuel for ocean-going liners. This paper by Professor Brame, who is a past president of the Institution of Petroleum Technologists, and was until recently Professor of Chemistry at the Royal Naval College, Greenwich, is the first publication since that event, to deal with the subject from a scientific point of view. Professor Brame is a high authority on fuel matters and his paper will be of especial interest.

DR. BERTRAM PRENTICE, D.Sc., F.C.S., the principal of the Salford Royal Technical College, has retired. During the 36 years Dr. Prentice has been associated with the College he has been largely responsible for building up the fine reputation which it possesses. Dr. Prentice has had a distinguished career which commenced in Edinburgh, where he received his early training at the Heriot Watt Technical College. After studying for a time in the research and physics department he was appointed private assistant to Professor W. H. Perkin. He assisted him for a year in organic research work and was then appointed a demonstrator and lecturer in chemistry.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

Johnson (W. & H.), Ltd., Hull, oil refiners, etc. (M. 8/10/32.) Registered September 27, mortgage to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on premises at corner of High Street and North Walls, Hull, also general charge.

Minerals Concentration Co., Ltd., Birkenhead. (M. 8/10/32.) Registered September 27, £2,000 mortgage and charge to G. H. Appleton, J.P., Meols Drive, West Kirby; charged on Dinmor Park Quarries, Penmon, also general charge. *£10,000. October 7, 1931.

Receivership

Cellulose and Allied Products (Hounslow), Ltd. (R. 8/10/32.) T. E. Chard, of 3 Central Buildings, Westminster, was appointed receiver and manager on September 19, under powers contained in debenture dated August 25, 1931.

London Gazette, &c.

Company Winding Up Voluntarily

GRIESS-PFLEGER TANNING CO., Ltd. (C.W.U.V. 8/10/32.) By special resolution, September 15. Mr. James H. Piper, appointed liquidator of the company.

Intended Payment to Preferential Creditors

SALTRATES, LTD., 145 Mortlake Road, Ilford. Last day for receiving proofs, October 15, 1932. Liquidator, George Digby Pepys, 33 Carey Street, Lincoln's Inn, London, W.C.2.

Company News

Wright, Layman and Umney (1932).—An interim dividend of 2½ per cent. is announced on the ordinary shares.

International Aluminium Co.—The preference dividend payment of 1¾ per cent. for the three months to June 30 last, is payable on October 15.

British Drug Houses, Ltd.—The usual quarterly dividend of 1¼ per cent. is announced on the preference shares and was payable on September 30.

Broken Hill South.—The net profit for the year ended June 30, amounted to £117,226 (Australian currency). For the previous year the net profit was £50,276.

Cheshire United Salt.—The report for the year ended June 30 last, states that the net profit was £335 (against £1,131 in the previous year) after making the usual allowances for depreciation.

Minerals Separation, Ltd.—An interim dividend of 5 per cent. less tax, has been declared payable on October 20 to members registered on October 14.

Dunlop Rubber Co., Ltd.—The interim dividend on the "A" and "B" preference shares of £1 each and on the "C" preference shares of 16s. each, will be paid on October 31 to shareholders on the register on October 17.

Chemical Trade Inquiries

Abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

British India.—The Director General, India Store Department Belvedere Road, Lambeth, London, S.E.1, invites tenders for 20 tons of permanganate of potash, B.P., (sample required with tender). Tenders due Tuesday next, October 11. Forms of tender are obtainable from the Director General at a fee of 5s., which will not be returned.

Spain.—A firm established at Barcelona wishes to obtain the representation of United Kingdom manufacturers of paints (liquid and paste), emery cloth, asbestos, tar, oil varnishes, etc. (Ref. No. 465.)

Forthcoming Events

Oct. 10.—Institution of the Rubber Industry (London and District Section). "Some Contributions to the Problem of Fabric Impregnation with Rubber." Miss Huenomoerder and Dr. E. A. Hauser. First Avenue Hotel, High Holborn, London.

Oct. 10.—Ceramic Society (Pottery Section). "Structure of Porcelain." A. L. Roussin. "Sillimanite." Dr. W. H. Taylor. 7.30 p.m. North Staffs. Technical College, Stoke-on-Trent.

Oct. 10.—Institute of Metals (Scottish Section). Address by the chairman, Professor Robert Hay. 7.30 p.m. 39 Elmbank Crescent, Glasgow.

Oct. 11.—Institute of Metals (Swansea Section). "Refractory Materials and the Non-Ferrous Industries." 6.15 p.m. Y.M.C.A., Swansea.

Oct. 11.—Institute of Metals (N.E. Coast Section). Address by the chairman, A. Logan. 7.30 p.m. Armstrong College, Newcastle-on-Tyne.

Oct. 11.—Institution of Petroleum Technologists. "Some Observations on the Study of an Oilfield." J. W. Weil. 5.30 p.m. John Street, Adelphi, London.

Oct. 12.—Institution of the Rubber Industry (Scottish Section). Annual General Meeting. "The Use of Automatic Control Devices in the Rubber Factory." E. P. Smith. Institution of Engineers and Shipbuilders, Elmbank Crescent, Glasgow.

Oct. 12.—Institute of Fuel. "The Treatment of Low Temperature Tars." Dr. J. G. King and Dr. M. A. Matthews. 6 p.m. Burlington House, London.

Oct. 12.—Diesel Engine Users' Association. "Steel Frames for Diesel Engines." C. H. Stevens. Caxton Hall, Westminster.

Oct. 13.—Institute of Metals (London Section). Address by chairman, S. L. Archbutt. 7.30 p.m. 83 Pall Mall, London.

Oct. 13.—Institute of Metals (Birmingham Section). Symposium on Hardness Testing. 7.30 p.m. University, Birmingham.

Oct. 13.—Society of Chemical Industry (Bristol Section). "The Importance of Humidity." Dr. R. H. Pickard. 7.30 p.m. University, Woodland Road, Bristol.

Oct. 13.—Institute of Chemistry (Manchester Section). "The Chemist and Commercial Life." 7 p.m. Reynolds Hall, College of Technology, Manchester.

Oct. 13.—Society of Dyers and Colourists (West Riding Section). Opening Address by the president, Lennox B. Lee. Bradford.

Oct. 14.—Institute of Metals (Sheffield Section). "Annealing." Captain F. Orme. 7.30 p.m. University, Sheffield.

Oct. 14.—British Association of Chemists (London Section). Smoking concert. 7.45 p.m. Broad Street Station Restaurant, London.

Oct. 14.—Society of Dyers and Colourists (London Section). "Wetting-out Agents, Advantages and Disadvantages." Dr. Alfred F. Kertess.

Oct. 14.—Chemical Engineering Group. "Colloidal or Coal-Oil Fuel." Professor J. S. S. Brame. 8 p.m. Burlington House, London.

SULPHURIC
ALL STRENGTHS
Hydrochloric, Nitric, Dipping, Hydrofluoric, Lactic, Perchloric
F. W. BERK & CO., LTD.
Acid and Chemical Manufacturers since 1870
106 FENCHURCH ST., LONDON, E.C.3
Telephone: Monument 3874. Wires: Berk, Phone, London
Works: Stratford, E., and Morriston, Glam.
TAS/Ch.145

OLEUM (all strengths)
Sulphuric Battery Dipping
Muriatic Nitric
SPENCER CHAPMAN & MESSEL Ltd.
With which is amalgamated WILLIAM PEARCE & SONS, Ltd.
WALSINGHAM HOUSE, SEETHING LANE, E.C.3.
Telephone: Royal 1166. Works: SILVERTOWN, E.16.
Telegrams "Hydrochloric, Fen, London."